

APRIL
1951

Chemical Engineering



GLASS A THOROUGH REVIEW OF THE PROCESS APPLICATIONS OF THIS VERSATILE MATERIAL **PAGE 117**

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APRIL
1951

Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

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April 1951

CHEMICAL ENGINEERING
Member ABC and ABP

Vol. 58—No. 4

Published monthly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office 99-129 North Broadway, Albany 1, N. Y.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 18, N. Y. Curtis W. McGraw, President; Willard Chevalier, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice President, Publications Division; Ralph B. Smith, Editorial Director; Nelson Bond, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Director of Circulation.

Subscriptions: Address correspondence to Chemical Engineering—Subscription Service, 99-129 North Broadway, Albany 1, N. Y., or 330 West 42nd St., New York 18, N. Y. Allow ten days for change of address.

Please indicate position and company connection on all subscription orders. Chemical Engineering solicits subscriptions only from executives and engineers in companies in which chemical engineering and processing form an important part of the total operation, and from consultants and laboratories whose field includes such process industries.

Single copies 50 cents. Subscription rates—United States and possessions, \$3 per year, \$4 for two years, \$5 for three years; Canada, \$4 per year, \$6 for two years, \$8 for three years; Pan American countries, \$10 per year, \$15 for two years, \$20 for three years; all other countries, \$15 per year, \$30 for three years. Entered as second-class matter Sept. 3, 1936, at Post Office at Albany, N. Y., under act of March 3, 1879. Printed in U. S. A. Copyright 1951 by McGraw-Hill Publishing Co., Inc. All Rights Reserved.

How Crystallization Procedures Have Been Improved

by Swenson



Above is the upper portion of a crystallizer showing booster, condenser, and 2-stage ejector. Below is the lower portion showing the level gauge, thermometer, and agitating mechanism.



LIQUID SCALE
FOR 12500074
140 SPUR 1.280

STORAGE

NOTE:
LEVEL IN TANK
TO HAVE 37
AVAILABLE
ON TOP OF
DOWN FOR
REPAIR.

CRYSTALLIZER

LEGEND

- WAVE HO
- WAVE FOV
- WAVE ME
- ↑ ATMOSPHER
- AND AGITATOR
- WAVE VALVE
- Y FUNNEL OR
USUAL OVERFLOW
- 1/2" ST. 16" STEEL PIPE
- 1/2" ST. 16" STEEL PIPE

CAUSTIC LIQUOR
COLLECTED FROM
OVERFLOW ALL
OVER THE PLANT

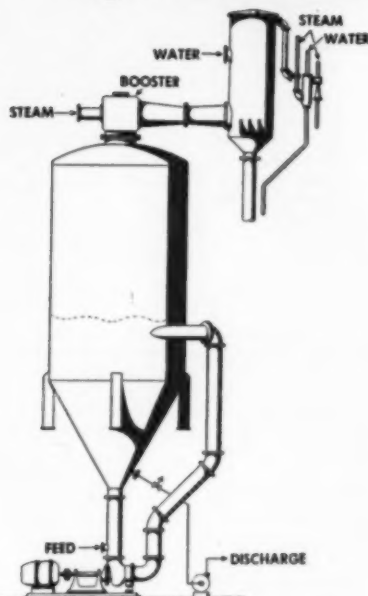
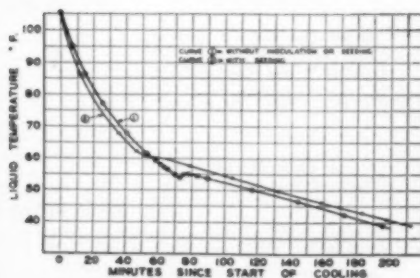


Diagram of single-stage continuous vacuum crystallizer with booster. A batch crystallizer requires no booster.



Typical curves for batch cooling with Swenson Vacuum Crystallizer



Process Engineering

When Swenson engineers developed the famous Swenson Vacuum Crystallizer, they made it possible to secure more uniform crystals and also to control the crystal size within limits. As a result, this equipment is applied to a wide variety of materials—in most cases with substantially reduced equipment and operating costs.

Evaporative cooling is employed. There are no hard-to-clean heat transfer surfaces to become fouled and no scrapers are required to prevent build-up of crystals.

The equipment may be adapted to batch or continuous operation—in multi-stage arrangements if desired. Many corrosive solutions are handled economically with rubber-lined crystallizers, saving the cost of expensive noncorrosive metals in construction.

Put **Swenson Process Engineering** to work on your problems—in the fields of crystallization, evaporation, filtration, or drying—while new processes or process improvements are still in the formative stage.

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SALT WASH VAC. FILTER

SWENSON 4" DIA. 30" HIGH, C.I.

Swenson Vacuum Crystallizers are used successfully in handling such materials as:

Ammonium Chloride
Ammonium Fluoromale
Ammonium Nitrate
Ammonium Sulfate
Baric Acid
Copper Sulfate
Disodium Phosphate
Ferrous Sulfate
Magnesium Chloride
Magnesium Sulfate
Manganese Sulfate
Potash Alum
Potassium Nitrate
Sodium Potassium Ferricyanide
Sodium Sulfate
Sodium Thiosulfate
Trisodium Phosphate
Zinc Sulfate

—also for organic chemicals such as:

Citric Acid
Dicyandiamide
Mannitol
Nitroguanidine
Pentacrythritol
Sodium Citrate
Sodium Sulfate
Sorbitol
Tartaric Acid

ONLY SWENSON PROVIDES THIS FIVE-WAY SERVICE

1

Analysis of Requirements



2

Design and Layout



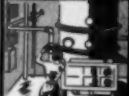
3

Manufacture of Equipment



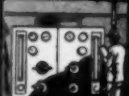
4

Test Operation



5

Periodic Check-Ups



Scale	1/2" = 1'-0"	For	
Appr.			
Appr.			
0-2225			

Where
Gases,
Fumes and Smoke
are present

AO 701 RUBBER FRAME

GOGGLE provides a gas-tight seal!



Companion model to AO's "700" Rubber Frame Goggle, the AO "701" is recommended where gas, fume and smoke hazards exist. There are no ventilation slots in the frame and the lenses have no hole for the strap. Acid resistant bolts and nuts replace strap on front of frame. Vinylite lens. GOGGLE MAY BE WORN OVER PERSONAL GLASSES. Your nearest AO Safety Products Representative can supply you.

QUICK FACTS

- Protects eyes against chemical splashes, spray, flying particles and fine dusts, as well as fumes, smoke and gases.
- Frame is molded for air-tight fit of non-irritating, acid-resisting neoprene.
- Bridge and other face-contacting edges have broad bearing surfaces for maximum comfort.
- Rubber headband is extra wide, easily adjustable.

American Optical

COMPANY
SAFETY PRODUCTS DIVISION

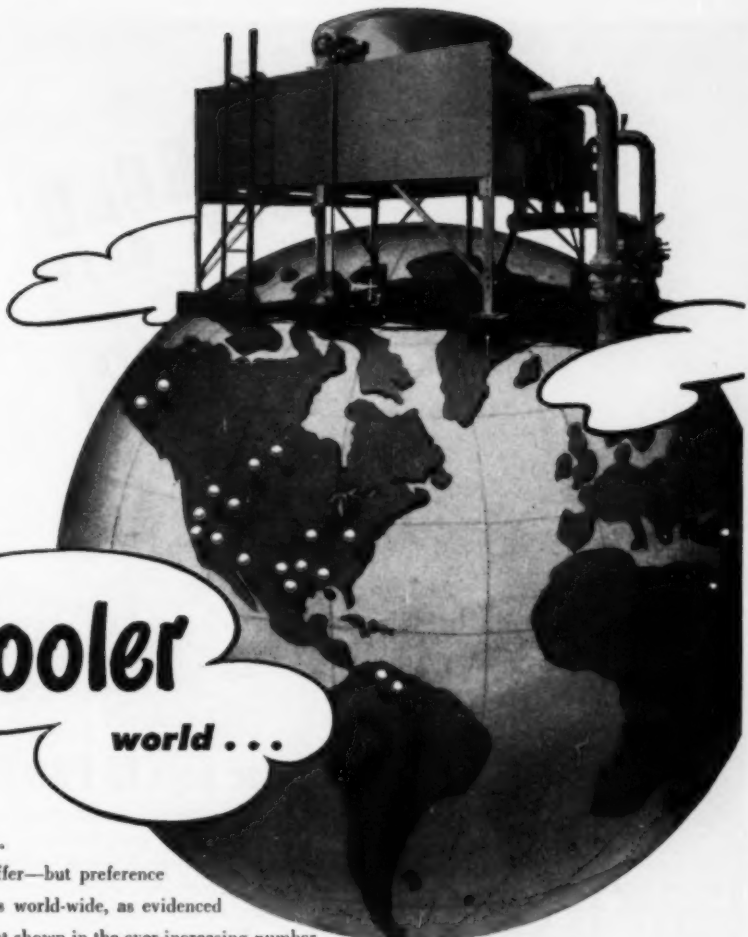
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to
Arabia**

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FROM ACTIVE DUTY**

When the '1000' VALVE
Goes on the Job . . .
These Troublemakers
are **THROUGH...**

CASH STANDARD
Streamlined
PRESSURE
REDUCING VALVE
TYPE 1000

WRITE FOR
BULLETIN
962



ITS ASPIRATOR AND
STREAMLINED FLOW WORK TO YOUR
BENEFIT IN THESE 12 WAYS . . .

CASH STANDARD
CONTROLS...
VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS



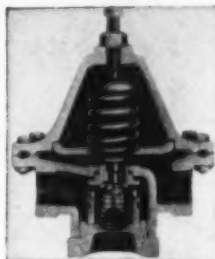
What this user says IS PROOF:

"The type '1000' valves we have in our plant are used on our heating system and washers and degreasers. Our heating system is almost entirely unit heaters and with varying conditions, the valves are called on to operate at both small capacities and wide open. When the wind is mild the valves are practically dead ended and when the weather is cold, the valves are called on to open and close very rapidly. On our washers and degreasers we don't have anything else but the Cash type '1000'. Our oldest valves in the plant are seven years old, but they are working perfectly."

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6. Accurate Regulation.
7. Speedier Production Results.
8. Elimination of Failures.
9. Constant Delivery Pressure.
10. Cost Saving Operation.
11. No Spoilage.
12. Practically zero in maintenance costs.

**BULLETINS
AVAILABLE
ON OTHER
CASH STANDARD
VALVES**

Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 954—features the CASH STANDARD Type 4030 Back Pressure Valve—designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air with any gas or oil that is non-corrosive and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

With
BIRDS
Like These
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IS

BETTER — if the solid particles (from one micron to $\frac{1}{4}$ ") are capable of settling and compacting under powerful centrifugal force, then the BIRD Filter is your disk. It produces a drier cake — handles almost any feed slurry in almost any volume, at almost any temperature.

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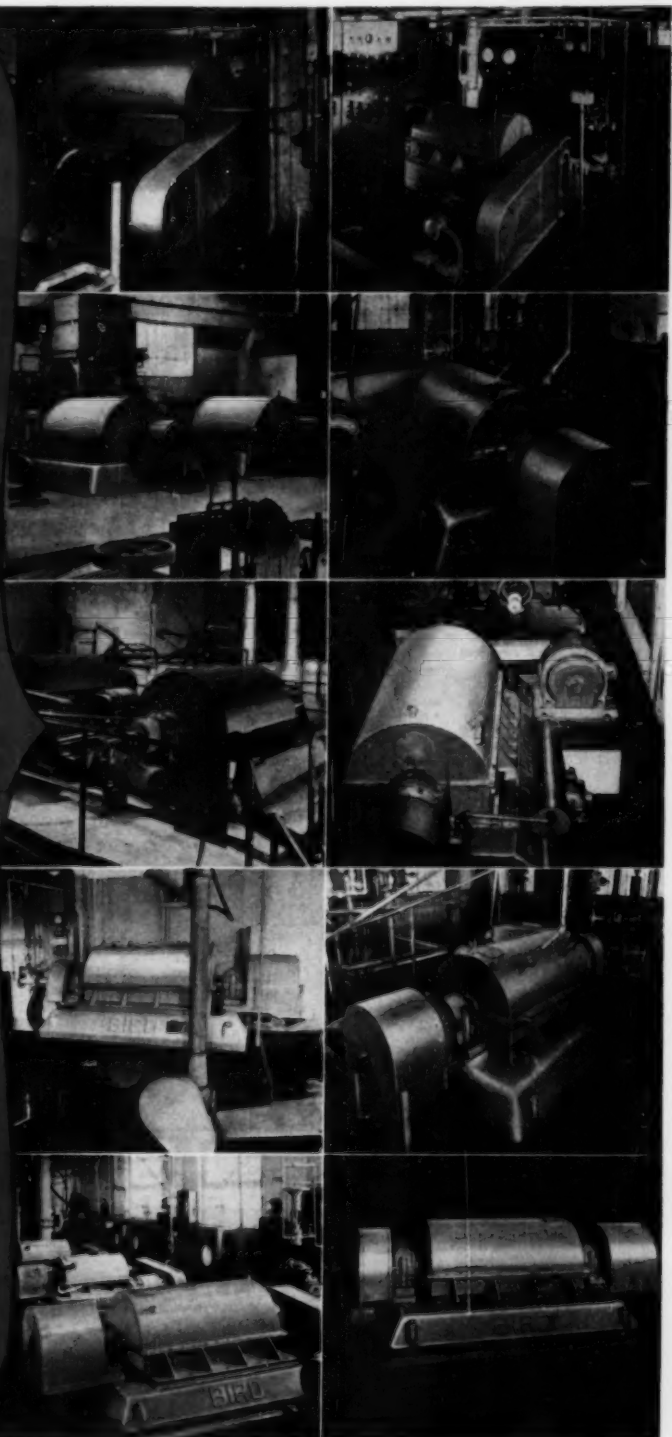
FASTER — material remains in the filter for only a few seconds — feed, and delivery of both dried solids and clarified liquids is continuous.

CLEANER — as you can see from all pictures, filtering is no longer a messy operation — everything is completely under cover, protected from contamination.

CHEAPER — minimum equipment — no operating labor — minimum floor space — low cost of installation, operation and maintenance.

Find out, now, what Bird Centrifugal Filtration can add to your production picture. The Bird Research and Development Center can quickly develop reliable performance facts in advance of any equipment investment on your part.

BIRD
MACHINE
COMPANY
SOUTH WALPOLE
MASSACHUSETTS





Chemical Progress

News of developments from General Electric's Chemical Department that can be important to your business.

New High-Strength G-E Silicone Rubber Compounds Offer Important Advantages to Fabricators and Their Customers

Heat resistance and improved mechanical strength now make both new and better products possible.

A new line of General Electric silicone rubber compounds now offers rubber processors and fabricators an unusual opportunity to make parts impractical to produce with previous silicone rubber compounds.

These new compounds combine high-temperature resistance with improved mechanical strength. They enable rubber manufacturers not only to improve present products, but to develop new and different ones

with profitable sales possibilities. The excellent molding and extrusion characteristics of these new compounds make the production of even intricate parts easy.

Customers to Benefit

Customers of rubber processors and fabricators will also benefit from the new high-strength compounds. Now they can expect to find silicone rubber in products where it was not possible before. Buyers should specify the new G-E silicone compounds in the parts or equipment they order.



Storage tanks at the G-E plant, Waterford, N. Y., source of the new, improved silicone rubber compounds.



A wider range of temperatures (-85 to 500F) can be withstood by products made of the new General Electric silicone rubber compounds. Sealing gaskets for oven doors, for example, will not soften, harden or stick even under intense heat.



Fabricators find the excellent hot strength of these new compounds means simplified handling techniques and shortened production cycles. Low specific gravity and neutral color are added advantages. Bonding is simple with G-E adhesives and primers.

For more information about G-E silicone rubber compounds or other chemical products, write to Chemical Department, General Electric Company, Pittsfield 12, Mass.

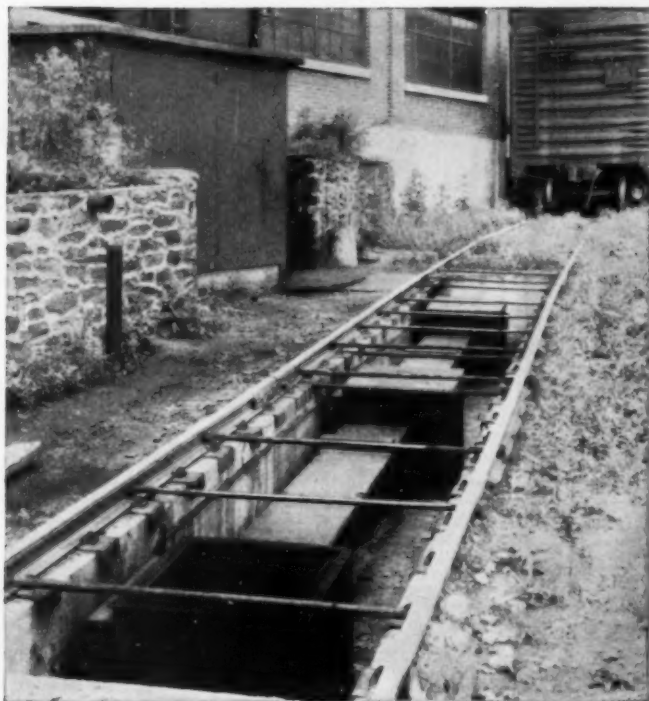
PLASTICS COMPOUNDS • SILICONES • INSULATING MATERIALS • GLYPTAL® ALKYD RESINS • PLASTICS LAMINATING, MOLDING, AND EXTRUDING

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HELICOID OR SECTIONAL CONVEYOR SCREWS — for general screw conveyor applications — may also be furnished in the metal and finish best suited to your purpose and with components selected from the most complete line.

← Trouble-free Link-Belt Screw Conveyor, equipped with three receiving hoppers, unloads tank cars of carbon black at this Pennsylvania tire plant.

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Remember, Link-Belt is the nation's top producer of materials handling and power transmission equipment . . . another reason why Link-Belt Screw Conveyors are simple, compact, have few wearing parts, greater dependability. Then too . . . they're accu-

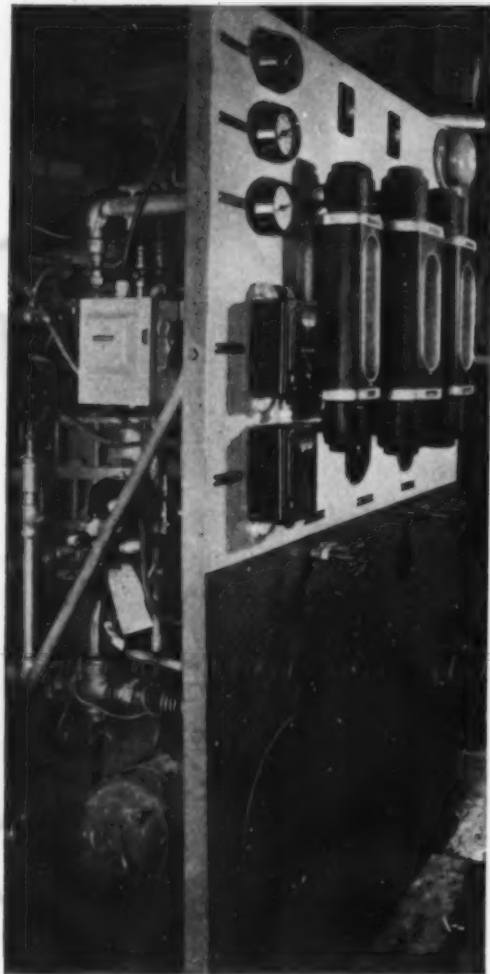
rately made to insure easy assembly and smooth operation.

And Link-Belt can supply all of the components — conveyor screws, collars, couplings, hangers, troughs, trough ends, flanges, thrusts, drives. Call the office near you for the complete story.

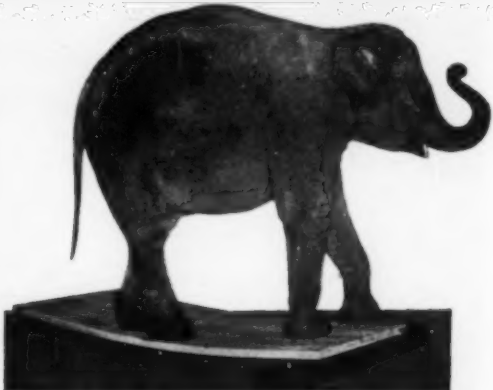
LINK-BELT
SCREW CONVEYORS

LINK-BELT COMPANY: Chicago 8, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities.

Life ...on the



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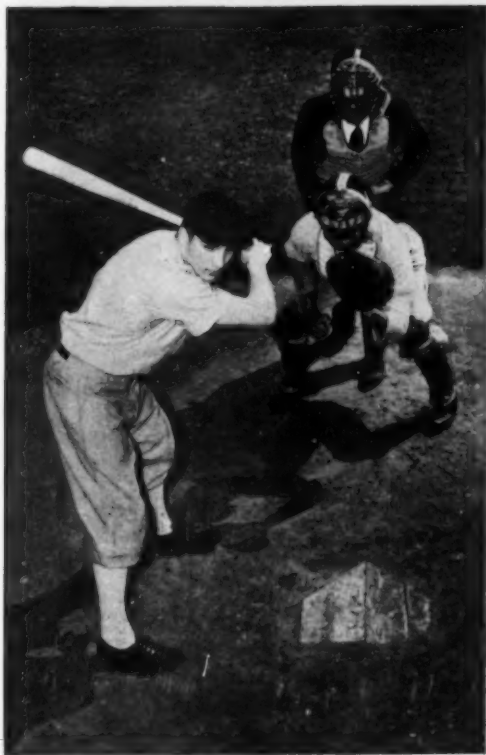


PROOF ON THE HOOF—over one ton of elephant recently put Cyanamid's MELURAC® Resin 300 to the test. Jumbo simply stood on a MELURAC bonded plywood door placed between two blocks. Slowly the panels bent... then steadied as the bonding held firm. Moral: even though elephants don't walk on your products, you can't beat MELURAC for a strong, sure bond.



TOMORROW'S HIGHWAY—that's a two word definition of the famous Pennsylvania Turnpike now being extended eastward to the outskirts of Philadelphia, westward to the Ohio border. Cyanamid explosives telescoped years into months when they helped move mountains of earth and rock to lay the way open for this modern highway. For more information about AMERICAN Explosives and blasting accessories made by Cyanamid, mail the coupon.

Chemical Newsfront



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Modified sodium polyacrylates of varying viscosities.

What are their properties?

Possess interesting thickening, stabilizing, and film forming characteristics. Apparently not affected by common molds and bacteria. Stable under storage at high temperatures. Water soluble anionic colloids, available as straw colored aqueous solutions.

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Data Sheet

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FRUEHAUF has, or can build, a TANK-TRAILER for every liquid hauling need!

The problems of hauling chemicals and chemical products are many and varied, and each demands special requirements of the vessel containing it. For this reason most chemical hauling tanks are "Specials". Fruehauf, the leading builder of Tank-Trailers, has probably built a unit with special features to haul your load, and . . . with all the outstanding qualities of a Fruehauf. Strength, durability and light weight are never sacrificed for special load carrying features.

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ENGINEERED TRANSPORTATION

Your Problem May Be DIFFERENT!

When you have a special problem of hauling, let Fruehauf build a Tank-Trailer for your particular needs. Problems such as flow, temperature and safety are solved by a staff of Trailer Engineers, and the unit built by skilled Fruehauf technicians. The result is an economical, long-lived Tank-Trailer built for the job, and backed by the world's largest builder of Truck-Trailers.



A new and comprehensive guide-book on Tank-Trailers is available upon request. It illustrates and describes many chemical hauling units as well as the standard line of Fruehauf Tank-Trailers.

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MONSANTO
CHEMICALS—PLASTICS

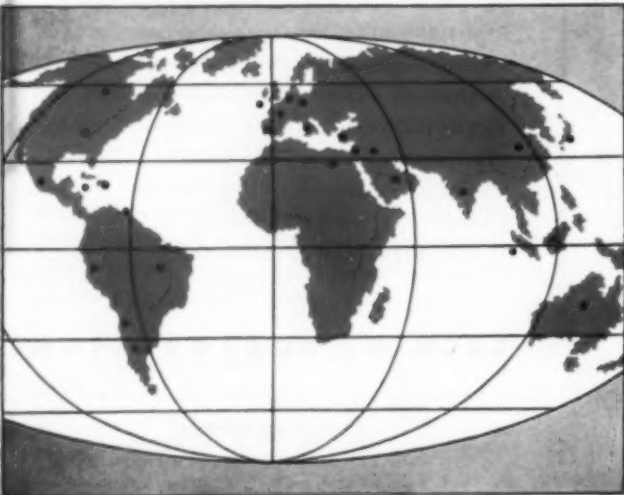
DESIGNS FOR MOBILIZATION PRODUCTION

On these pages, Monsanto presents three designs that may play a vital role in your production for mobilization. You may have the counsel of Monsanto engineers concerning these structures without cost and without obligating yourself or your company. For information, mail the coupon, wire or telephone MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1702 D St. Second St., St. Louis 4, Missouri. Telephone MAIn 4000.

Use Monsanto's thirty years' experience in design and operation of sulfuric acid plants



MATHIESON CHEMICAL CORPORATION'S sulfuric acid plant at Pasadena, Texas, is built on a Monsanto design. (Photo courtesy Mathieson Chemical Corporation.)



MONSANTO VANADIUM CATALYST...employed in more than 250 plants in 26 countries...is used to produce more than 40% of the free world's sulfuric acid.

If you are thinking of building facilities to produce your own sulfuric acid for mobilization production, get in touch with Monsanto. It will cost you nothing and put you under no obligation to consult with a Monsanto representative who will bring you more than thirty years' experience in the design, construction and operation of sulfuric acid plants.

Monsanto's standard designs have many exclusive features. They offer you these advantages:

1. **CAPACITY** to meet your needs. Plants range in size from five to five hundred tons of acid (100% H_2SO_4 basis) daily...with no equipment in parallel.
2. **FLEXIBILITY.** Monsanto-designed plants operate from 30% of rated capacity to more than capacity without "blanking off" or other operations that consume time and labor.
3. **EFFICIENCY and ECONOMY.** Monsanto-designed plants give top efficiency...low operating cost...low maintenance cost. They deliver by-product steam that saves you money.

More than 250 Monsanto-designed sulfuric acid plants are in operation throughout the world. Many of them more than paid for the cost of construction in a surprisingly short time. Mail the coupon for information. If you wish, a Monsanto representative will call, study your problem and give estimates.

Monsanto Vanadium Catalyst Employed in 26 Countries

Monsanto Vanadium Catalyst, made especially for producing sulfuric acid by the contact method, is employed by plants in 26 countries. These plants deliver more than 40% of the free world's production of sulfuric acid.

Monsanto Vanadium Catalyst is highly efficient, rugged and long-lasting. It serves in the following countries:

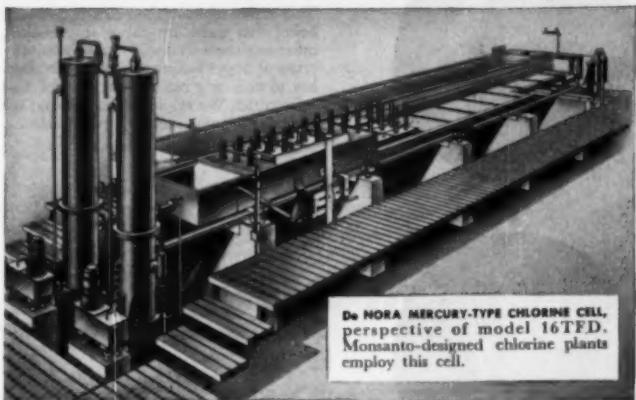
U. S. A.	Peru	Palestine
Canada	United Kingdom	Iraq
Mexico	Holland	Iran
Cuba	France	India
Trinidad	Spain	Sumatra
Curacao,	Italy	Borneo
N. W. I.	Turkey	Australia
Argentina	Egypt	China
Brazil		Japan
Chile		

You can make chlorine and caustic with this plant

If you're concerned with additional supplies of chlorine and caustic, contact Monsanto for details on manufacturing these products yourself . . . Monsanto offers you engineering service on the Monsanto Electrolytic Chlorine Process, which has these advantages:

1. In addition to producing chlorine of high purity, Monsanto-designed plants deliver rayon-grade caustic up to 73% without evaporators or purification . . . 2. All or part of the caustic production may be replaced by production of sodium sulfide or various other products . . . 3. The Monsanto process employs the De Nora mercury-type cell which has been used commercially for fourteen years. Of all mercury-type cells, this is the most rugged and compact. It requires a minimum of maintenance and a minimum of floor space.

Mail the coupon, or wire for complete information.



De NORA MERCURY-TYPE CHLORINE CELL, perspective of model 16TFD. Monsanto-designed chlorine plants employ this cell.

Refinery sludge recovery turns waste into useful products



SLUDGE RECOVERY INSTALLATION—Combustion chamber and scrubbing tower (left), single decomposer unit (right), as added to an existing contact sulfuric acid plant (background).



EVEN HIGH-VISCOUS SLUDGE can be processed in Monsanto-Ross-Wilde Unit by mixing it with more-fluid sludge.

VARIOUS TYPES OF SLUDGE, containing low or high concentrations of acid, can be processed in Monsanto-designed plants.



WRITE FOR BROCHURE describing the Monsanto-Ross-Wilde process of sludge acid recovery.

AUTOMATIC CONTROLS, incorporated directly into the package unit, reduce manual attention to a minimum in the Monsanto-Ross-Wilde installation.



You can make clean, high-grade sulfuric acid from most refinery sludge acids when you install a Monsanto-Ross-Wilde Sludge Recovery Unit. If H_2S is available, it can be used in the same equipment. In addition to the acid, which can be sold or used in your processes, the unit produces by-product steam for heat or power. In some cases, it recovers oil that can be refined into salable merchandise.

Thus you change refinery wastes into products that are worth money. You save the expense of disposing of sludge acid and H_2S . You improve your community relations by avoiding air and stream pollution.

The Monsanto-Ross-Wilde Sludge Recovery Unit will operate with your contact sulfuric acid plant, or, it can be erected with a Monsanto-designed sulfuric acid plant as a single project.

At your request, a Monsanto representative will be glad to visit your refinery, estimate the cost of a Monsanto-Ross-Wilde installation and show you how much you can save on disposal costs . . . how much you can realize from changing waste materials into useful products.

MONSANTO
CHEMICALS AND PLASTICS

Please send information on the following without cost or obligation:

- ☐ Sulfuric Acid Plants
- ☐ Chlorine Plants
- ☐ Refinery Sludge Acid Recovery Plants
- ☐ Booklet, "Monsanto-Ross-Wilde Process of Sludge Acid Recovery"
- ☐ Have a Monsanto representative call upon us.

MONSANTO CHEMICAL COMPANY

Organic Chemicals Division
1702-D South Second Street, St. Louis 4, Missouri

Name.....Title.....

Company.....

Street.....

City.....Zone.....State.....



This series of advertisements is presented in the belief that there are chemical, metallurgical and other engineers who will find in some of the properties of Super Refractories by CARBORUNDUM the key to new or more effective uses of heat—and of refractories. We would like to talk over specific jobs with anyone who sees such possibilities.



Here's a refractory as rapidly as



Super Refractories by CARBORUNDUM possess a number of interesting properties not usually associated with refractory materials—properties that can be used to obtain unusual results.

Among these products are CARBOFRAX silicon carbide refractories. And one of their unusual characteristics is high heat conductivity. *At elevated temperatures, this property closely approximates that of nickel-chromium alloy steels.*

This characteristic has led to interesting applications. For example, it is not obvious that high heat conductivity is an advantage in checker brick—but it is. CARBOFRAX brick, when used in checker work, absorb—and deliver—two to five times as much heat as fireclay brick in a given period of time. You can recover more heat with fewer brick (and therefore

with smaller regenerators, less pressure loss.) Or you can get higher temperatures if you want them. Even one or two rows of CARBOFRAX brick will often make a lot of difference.

Among other applications where high thermal conductivity is important: Tubes and tile in recuperators. Muffles or hearths in heat-treating furnaces. Water-wall boilers, where CARBOFRAX shapes protect the tubes while transmitting heat to them. Even arc shields on circuit breakers, where CARBOFRAX plates help quench the arc by conducting heat from it.

In the box below you'll find other characteristics of this unusual material. Do any of these suggest applications to you? If so, we'd like to discuss them with you, either in person or by letter. Won't you write or call us at Perth Amboy, N. J.?



These are some of the characteristics of CARBOFRAX Super Refractories

- They readily withstand temperatures up to 2800°F and under certain conditions up to 3200°F.
- Their resistance to abrasion is excellent. (An application: In slab-heating furnaces, CARBOFRAX skid rails have proved superior to alloy steel and water-cooled pipes.)
- They are far stronger, in all temperature ranges, than practically all other refractories.
- In most cases, they'll outlast ordinary refractories many times.
- The coefficient of expansion is very low—.000005 per degree C between 25° and 1400°C. Spalling is rarely experienced.
- They remain extremely hard at most furnace temperatures, and therefore offer no footing for clinker or slag accumulations.



that **CONDUCTS** *heat* *chrome-nickel steels*

Could you use this material to get . . .

- ☐ highly efficient vertical retorts?
- ☐ more effective muffles and hearths?
- ☐ more productive regenerative equipment?
- ☐ better heat transfer in any process involving either high or moderate temperatures?

CARBOFRAX refractories are available as brick and as special shapes molded to very close tolerances—including fitted joints, tubes, etc. They are not, however, a universal cure-all, and should be applied with caution where iron oxides or basic fluxes are present at high temperatures. Under such conditions, other CARBORUNDUM Super Refractories, particularly MULLFRAX electric furnace mullite or ALFRAX electrically fused alumina, will probably prove better fitted.

We have a booklet which outlines all Super

Refractories by CARBORUNDUM. You'll find information about refractory materials which, for example, are chemically inert, or highly erosion resistant, or light in weight, etc.

The "custom-made" qualities of these special purpose refractories may go hand-in-glove with your uses of heat. Why not check up? The coupon will bring you the story—or one of our engineers will be happy to talk over possibilities. We believe it could be mutually profitable.



THE CARBORUNDUM COMPANY

Refractories Division

Perth Amboy, N. J.

"Carborundum," "Carbofrax," "Mullfrax" and "Alfrax" are registered trademarks which indicate manufacture by The Carborundum Company.

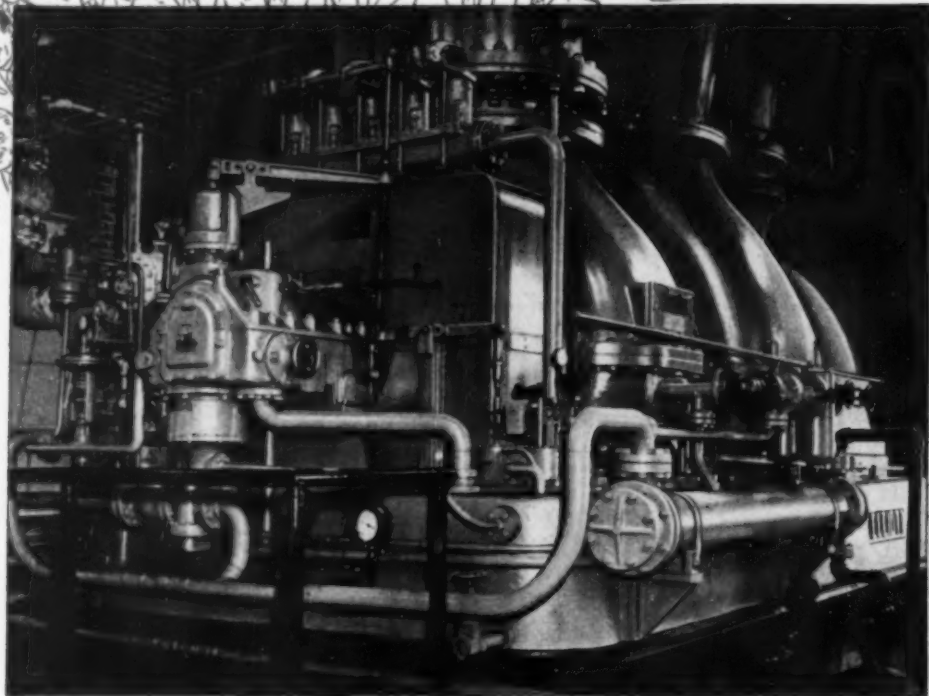
Dept. H-41
Refractories Div., The Carborundum Co.
Perth Amboy, New Jersey
Please send your free booklet on Super Refractories

Name
Position
Company
Street
City Zone State

*The talk of the
oil industry!*



**... ALL
FOR**



NEARLY TWO YEARS WITHOUT STOPPAGE

The Elliott turbine-driven centrifugal blower, which contributed to this outstanding record, has a capacity of 50,100 inlet cfm and discharges at 15 psig; the driving turbine develops about 3500 hp at 3740 rpm. Blower provides air for catalyst regeneration and for circulation of catalyst at a rate of 1200 tons per hour.

**ELLIOTT
COMPANY**

Centrifugal Blower Dept.,

RECORDS BROKEN NON-STOP OPERATION

THE ELLIOTT BLOWER

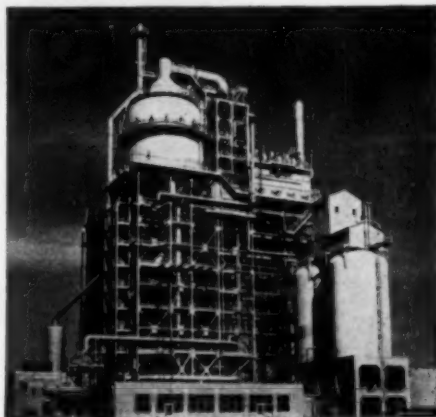
pictured at the left, located at the Sunray Oil Corporation plant, Sunray, Okla., near Duncan, is helping to make history in fluid catalytic cracking. Starting operation in March, 1949, it has already exceeded all previous long-run records and, up to Jan. 13, had piled up the amazing total of 677 days with no evidence of fatigue or drop in efficiency. This operating record is a real tribute to the equipment making up the cat cracker unit and to the operating personnel of the refinery.

This is the record Elliott Blower

to carve itself a niche in the industrial hall of fame. The previous non-stop record in catalytic cracking, 610½ days, was also made with the aid of an Elliott blower at the refinery of the Tidewater Associated Oil Company, Avon, Calif. *It takes an Elliott blower to beat an Elliott blower.*

In many other refineries Elliott blowers, driven by Elliott turbines or motors, are demonstrating their dependability — contributing savings instead of maintenance costs. If you value this type of performance, check with Elliott engineers regarding your own specific requirements.

It should be added that numerous Elliott mechanical drive turbines are also a part of this cat cracker unit, contributing their share to the non-stop run.



The fluid "cat cracker" at Sunray Oil Corporation, Sunray, Oklahoma, was originally built and operated by Associated Refineries, Inc. during World War II. After remaining idle for several months, the refinery was purchased by Sunray in 1947 and was again put on stream in the spring of 1948. It has now been in continuous operation since March, 1949.

P-1091

JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
AMFEE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

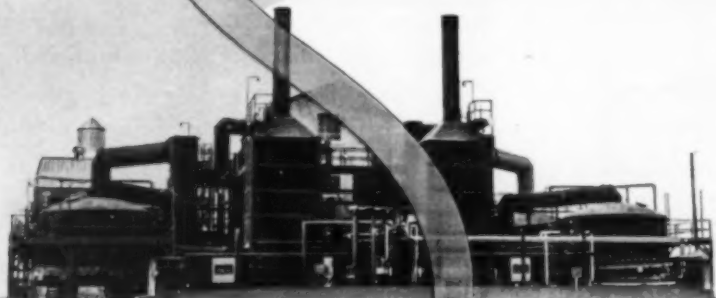


SULFUR RECOVERY

from waste gases

ANOTHER FOSTER WHEELER INSTALLATION—
THE LARGEST IN THE WORLD—YIELDS

SULFUR — from a new source

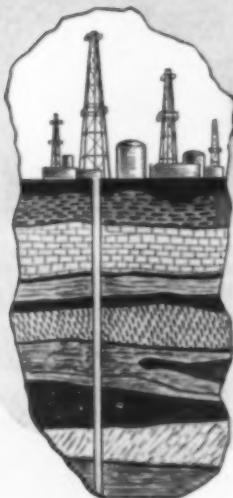


Once again, a Foster Wheeler plant proves that the recovery of sulfur from sour natural gases and spent gases in refining operations is a good business. Over 300 tons of high grade sulfur per day are recovered by the Texas Gulf Sulphur Company's plant at Worland, Wyoming, which was placed in operation in April, 1950.

Today, the plants installed by Foster Wheeler have a total capacity of 600 or more tons per day, a substantial contribution to the development of the country's resources of sulfur—an essential element for the chemical, petroleum, fertilizer, steel, and other industries. Foster Wheeler has been identified with this development since the first commercial installation in the United States in 1942.

For further particulars, write:

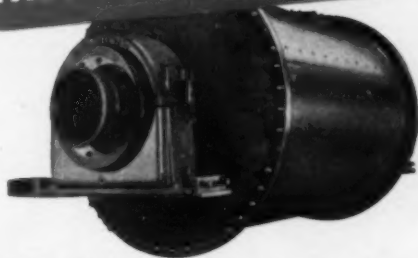
FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.



FOSTER WHEELER

Engineered for Grinding Mills

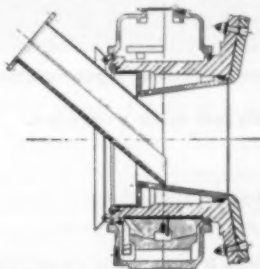
ALLIS-CHALMERS TRUNNION BEARING



EXTRA LARGE — Diameter of king-size Allis-Chalmers trunnion bearing is almost twice the bearing length, large enough to permit spout feeding. Large bearing proportions will provide long service despite heavy-going demands on mill. Internal oil system can be checked visually by means of hinged flap on bearing housing.



LOW BEARING PRESSURE — A spherical seat keeps mill in perfect alignment with bearings. Load is distributed evenly across full face of bearing, reducing wear. Cooling coils embedded in babbitted bearing cool the oil at point where most heat is generated. Piston ring seals hold oil in and dirt out . . . oil supply is always clean.



LONG BEARING LIFE — Internal oiling buckets carry lubricant to oiling pan. Oil is supplied the instant mill is started. All large bearings are fitted with lubricant pump for floating the mill during starting. This overcomes high starting torques and eliminates "dry" starting after shut-downs, which causes about 75 percent of bearing wear.



During normal operation, a film of lubricant separates trunnion from bearing. No metal to metal contact.



After a short shut-down period the thickness of this protecting film of lubricant is reduced.



After long shut-down, lubricant film is broken entirely. The result is damaging metal to metal contact between trunnion and bearing.



Lubricant pump floats the mill before starting . . . re-establishes protecting film of oil. Power needed for starting is greatly reduced, too.

Additional facts about trunnion bearings and other modern features of Allis-Chalmers grinding mills may be obtained without obligation from the A-C representative in your area or by writing to: Allis-Chalmers, Milwaukee 1, Wisconsin.

Taxrope is an Allis-Chalmers trademark.

A-3348

Trunnion bearings are built by Allis-Chalmers in 10 sizes from 14 x 8 to 54 x 22-in. The six smallest sizes are available as grease lubricated bearings; seven largest sizes as oil lubricated bearings.

ALLIS-CHALMERS

Sales Offices in
Principal Cities in
the U. S. A. Distributors
Throughout the World.



Motors



Controls



Taxrope Drives



Vibrating Screens



Crushers



Kilns, Coolers, Dryers





*There's one man who
can help you control
temperatures accurately
—economically*

He's the man who can show you the proper insulation to get maximum heat and power from each fuel dollar expended.

*Here's one insulation
that will save you money*



**EAGLE-PICHER SUPER "66"
INSULATING CEMENT**

Super "66" is all-purpose, rust-inhibitive, extremely adhesive insulating cement. "Springy ball" pellets don't collapse after application . . . give great coverage, retain their thermal efficiency. 100 lbs. covers 66 sq. ft.—1 inch thick! Easily applied with trowel, over flat and irregular surfaces. Efficient for temperatures up to 1800°F. Reclaimable when used on equipment whose temperatures do not exceed 1200°F.

An Eagle-Picher Industrial Insulation distributor or representative can help you reduce operating expenses because he has available a wide line of insulation products—for high and low temperatures—scientifically designed for maximum thermal efficiency, and practical application. Why not let him give you more information about some of the products listed here?

These Eagle-Picher products can save you money . . . power . . . time

**Insulating Felts • Supertemp Blocks • Blankets
Loose Wool • Pipe Covering • Stalastic • Insulseal • Insulistic
Swatchek • Finishing Cements • Insulating Cements
Fireproofing Cement • Diatomaceous Earth Blocks**

THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

*Insulation products of efficient mineral wool—for a full range
of high and low temperatures. Technical data on request.*



Since 1843

*Get maximum
fuel savings and exact
temperature control
with these versatile,
efficient insulations*

For a completely effective, low-cost insulation combination, you can't beat the teamwork of Eagle-Picher Mineral Wool Blankets, Supertemp Blocks, Super "66" Insulating Cement, No. 106 Fireproofing Cement and Insulseal. They work effectively to give your equipment highest possible thermal efficiency . . . cut operating costs by saving maximum amount of fuel . . . and help to provide perfect, precise control over temperatures.



EAGLE-PICHER FIREPROOFING CEMENT

Mixed with water to form a stiff plastic mix for easy application on ribbed lath. Recommended for fireproofing structural steel columns, steel tank supports, skirts and equipment bases. Has high dry coverage of approximately 30 sq. ft. 1 inch thick per 100 pounds. Adds fire protection, patented rust-inhibitor resists corrosion. Tested by Underwriters' Laboratories, Inc.



EAGLE-PICHER MINERAL WOOL BLANKETS

These blankets satisfy the need for a convenient method of quickly and efficiently insulating flat or curved surfaces on larger types of heated equipment. Mineral wool is felted and secured between flexible metal fabric. Outstanding physical and chemical stability enables Eagle-Picher Blankets to resist water, steam, corrosive fumes and normal vibration.



EAGLE-PICHER SUPERTEMP BLOCKS

Eagle-Picher Supertemp Blocks are lightweight (approximately 16 lbs. per cu. ft.). Can be cut easily with knife or saw to fit off-shaped areas . . . they fit snugly over minor irregularities. They're strong and have high refractory value. Withstand temperatures up to 1700° F. Conductivity at 512° F. approximately 0.43 . . . all standard sizes, from 3" x 18" to 12" x 36" . . . in thicknesses from 1" to 4".



EAGLE-PICHER INSULSEAL

A tough, weatherproof, protective coating for insulation. For temperatures up to 450° F. Applied as a plastic, its smooth troweling qualities assure uniform coverage, proper thickness. It protects insulation from air infiltration, fumes, rain, snow, vibration, punctures, and withstands severe service, indoors or out. Dries to a smooth, rich black, has a neat appearance on hot or cold surfaces . . . may be washed or painted.

THE EAGLE-PICHER COMPANY General Offices: Cincinnati (1), Ohio

Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.



Since 1843

THE "SPECIAL" MILL YOU ARE DREAMING ABOUT

In a century of building processing machinery, Farrel-Birmingham has designed mills for almost every conceivable application. This means that, ordinarily, *any mill needed* can be furnished from existing drawings and patterns. However, if the equipment you require really is special, Farrel-Birmingham is prepared to engineer a mill with any combination of design features and attachments necessary to fill your needs.

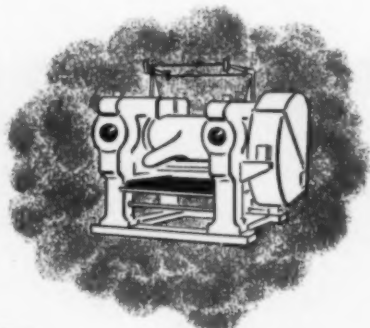
The basic design and construction of Farrel-Birmingham mills have been thoroughly tested for many years by thousands of successful installations for a variety of applications. A steady progression of improvements has brought them to their present-day point of high efficiency and refinement of design.

For further details of Farrel-Birmingham mills, send for a copy of Bulletin 173. No cost or obligation.

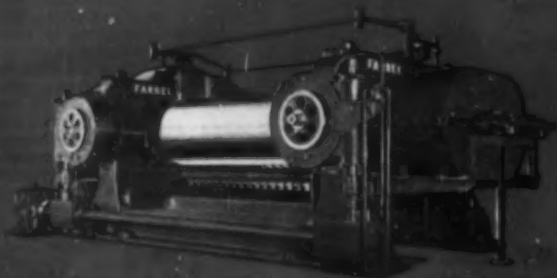
FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

Farrel-Birmingham®

***may not be
special at all***



FE-407



TWO EXTREMES

A giant 28" x 100" mill, specially designed for processing butyl rubber, contrasted with a 6" x 13" laboratory mill. Both were designed to meet individual requirements.





This close-up clearly shows the ribs or corrugations which add strength to Childers Jacketing and also make it form more easily around lines. Aluminum strapping and seals are a quick, inexpensive way to attach the jacketing. They can be used without any special tools and take no special training for the installers.

Does long lasting aluminum cost too much for covering your insulated lines? Not when you specify this new type weather-proof jacketing. It has been specially developed to cost little more than ordinary temporary jacketing materials.

New Low-Cost Jacketing Cuts Maintenance on Insulated Lines

AT LAST an aluminum jacket has been "engineered" especially to protect outdoor lines in refineries and chemical plants. It is the first "permanent-type" jacketing that offers both low initial cost and low application cost.

After two years of tests and major installations at 431 outdoor locations in chemical plants, refineries and power plants, the Childers Manufacturing Co. of Houston has rung up an impressive cost-cutting record with their Childers Aluminum Jacketing.

Secret behind this low cost is the thin aluminum sheet—.006" thick—which is the weather-protecting sheath of the jacketing. It is ribbed (as pictures show) for extra strength and to facilitate form-

ing around the line. This aluminum has proved thick enough to resist weathering and usual abrasion, but costs much less than heavier aluminum sheets.

Easy application of this Childers Jacketing cuts labor bills drastically. It comes from the factory in easy-to-handle rolls that are four feet wide and either 100 feet or 200 feet long. It is light and flexible to handle as the men put it on the line. No roll forming required as with heavy, un-crimped material. It can be cut off and attached just the same as the old-fashioned tar-paper that was sometimes used for jacketing.

You can attach Childers Jacketing around your insulated lines by one of several easy methods. The use of aluminum strapping and seals is probably the best. Sheet metal screws or Minnesota Mining's No. 471 tape can also be used.

The Childers jacketing can be removed and re-used.

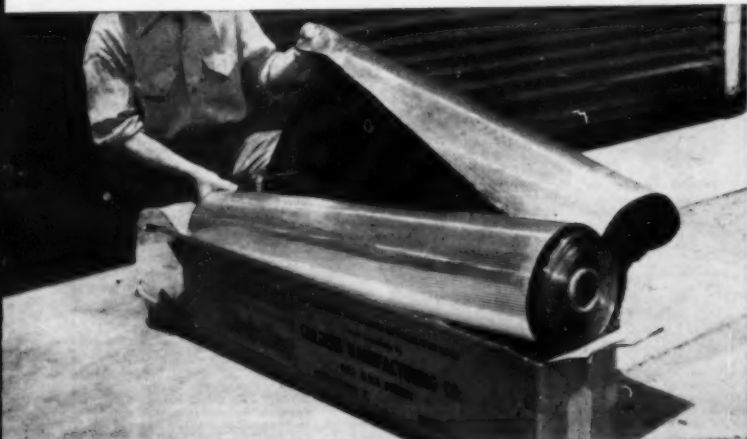
A moisture barrier is attached to the back of the jacketing to give positive protection for the aluminum when it is used with alkaline insulating materials.

No painting, no rust-proofing, little maintenance—that's the advantage of aluminum!

Hundreds of design engineers and maintenance engineers have agreed they save money for their firms and trouble for themselves by changing their jacketing specs to Childers 100%. That should make it worth your testing too—and a test roll costs only \$40.00 for 400 sq. ft. (with moisture barrier attached—price for 800 sq. ft. without moisture barrier \$62.00). That's a good investment in any plant. (Advt.)

★ ★ ★

FOR FULL INFORMATION write Childers Manufacturing Co., Dept. CE-1, 625 Yale St., Houston 7, Tex., for complete literature. Childers has engineering representatives in principal cities to work with you on specific problems.

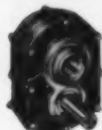


This is how Childers Aluminum Jacketing is shipped in easy-to-handle rolls. It is quite flexible, yet stands up under severe weathering.

IF IT'S DODGE -IT'S DEPENDABLE!



TAPER-LOCK SHEAVES: Patented. Taper-Lock is the world's simplest mechanism for mounting wheels to shafts. Easy on—easy off! 476 stock sizes in A, B, C and D grooves.



TORQUE-ARM SPEED REDUCERS: America's most complete line of shaft mounted speed reducers. Capacities from 1 to 27 h.p. Output speeds from 12 to 330 r.p.m.



DODGE-TIMKEN BEARINGS: Mounted units, proved in millions of industry's toughest jobs. The famous 30,000-hour line. Four types to choose from. Sizes from 1-3/16" to 8".



ROLLING GRIP FRICTION CLUTCHES: No toggles! Compact, flexible, smooth and **DEPENDABLE**. Bolted plate and gear tooth plate. 1.3 to 21.2 h.p. at 100 r.p.m.



SLEEVE BEARINGS: Precision built, exceptionally quiet, thoroughly dependable. "Taper" for fan and blower service. Sizes 1-7/16" to 8" in both plain and water cooled types.



SOLID STEEL CONVEYOR PULLEYS: Maximum strength, minimum weight. Modern pulleys with interchangeable hubs that cut installation cost. Diameters 6" to 6'. All face widths.



DODGE SEALED-LIFE V-BELTS: Special protection for tension members insures longer belt life. Perfectly matched to Taper-Lock sheaves for best performance.



DODGE TAKE-UPS: Modern, rugged, dependable. Roller bearing (illustrated), ball bearing and babbitted. Shaft sizes from 3/4" to 4". Travel from 4" to 36".

**SPECIALISTS IN POWER TRANS-
MISSION MACHINERY FOR 73 YEARS**

**NOTED THROUGHOUT THE WORLD
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**MANUFACTURERS OF A BROAD LINE
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**ORIGINATORS OF NEW AND
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**USED CONFIDENTLY WHERE
THE GOING IS TOUGHEST**

DODGE MANUFACTURING CORPORATION, 200 Union St., Mishawaka, Ind.

CALL THE TRANSMISSIONEER: Most Dodge products are normally available from distributors' stocks — in your territory — when you need them. For information on the newest and best methods of mechanical power transmission, call the Dodge Transmissioneer, graduate of the Dodge factory course. He is your local Dodge Distributor. Look for his name under "Power Transmission Equipment" in your local classified telephone directory.



PILLOW BLOCKS: Roller Bearing, Ball Bearing, Babbitted. **FLANGE BEARINGS:** Roller, Ball, Babbitted. **HANGER BEARINGS:** Roller, Ball, Babbitted. **TAKE-UPS:** Roller Bearing, Ball Bearing, Babbitted. **BASE PLATES, FLOOR STANDS, DROP HANGERS, V-BELT SHEAVES:** Both TAPER-LOCK and Bored-to-Shaft Size. **BELTS:** Industrial and FHP V-Belts and Flex-Link Belting. **SPEED REDUCERS:** TORQUE-ARM Shaft Mounted Speed Reducers. **CLUTCHES, FRICTION:** Rolling Grip, Diamond D and Solid Types. **COUPLINGS:** TAPER-LOCK Flexible, TAPER-LOCK Rigid and Flange Types. **SAFETY SET COLLARS, PULLEYS:** Steel Split Transmission and Solid Steel Conveyor Pulleys. Rubber Lagging. **VICES:** SLIDE-SET Machinist's... **FOR COMPLETE LINE, TYPES AND SIZES, WRITE FOR BULLETINS AND 224-PAGE CATALOG.**

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of Mishawaka, Ind.

"First in Power Transmission Machinery!"



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*For Quality Ammonium
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Soda Ash • Caustic Soda • Caustic Potash • Chlorine • Potassium Carbonate • Nylon
 Calcium Chloride • Sodium Bicarbonate • Specialty Cleaners • Ammonium Bicarbonate
 Sodium Nitrite • Para-dichlorobenzene • Ortho-dichlorobenzene • Monochlorobenzene
 Methanol • Ammonium Chloride • Formaldehyde

COMPARE

THIS FEATURE

OF THE HONEYWELL

SERIES "700"

VALVE

* Compare the bonnet of this valve with that of any other wide band proportional type. Look at it closely . . . study it feature by feature.

Then check the other features of the valve . . . the Specially Designed Diaphragm, the Duplex Upper Stem Guide, the Packless Bellows Seal, the Safety Stem Lubricator, the wide variety of discs, the easy reversibility in the field.

Your comparison will prove that the Honeywell Series 700 has *all* the features you look for in a fine valve.

It's available in a wide range of styles and sizes. For detailed information, write for a copy of Catalog 700-2, or call in your local Honeywell engineer . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, 1904 Windrim Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

*New Bulletin 750,
"Control Valve Sizing Data,"
is now available*



**ONE-PIECE
BONNET**

One-Piece Bolted Bonnet of forged steel provides greater ruggedness, simplifies removal for maintenance. Stuffing box is an integral part of bonnet, depth at least six times diameter of stem. Lantern Gland is double packed (top and bottom) . . . added protection against leakage.



*Specially Designed
Neoprene Diaphragm*

*Duplex Upper
Stem Guide*

*Packless
Bellows Seal*

*Safety Stem
Lubricator*

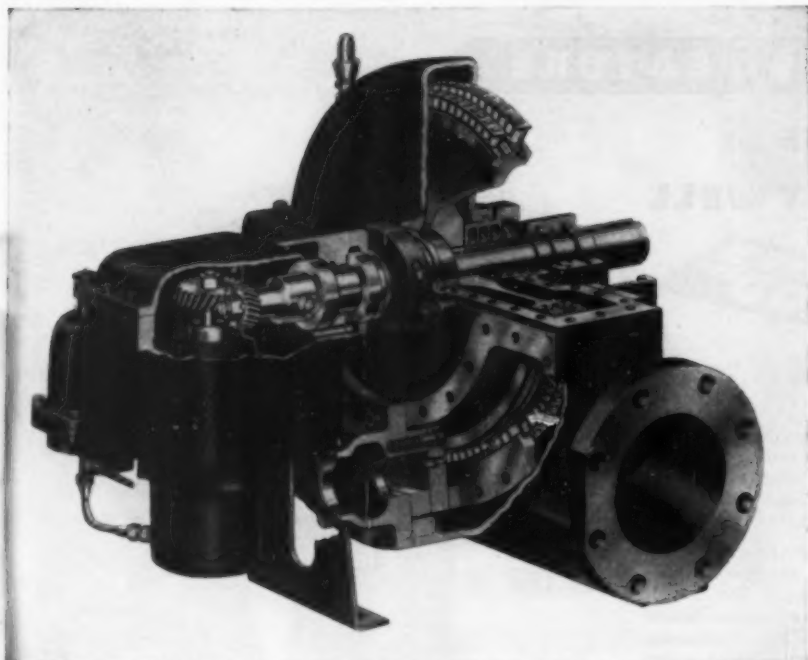
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of Discs*

*Reversibility
in the Field*

MINNEAPOLIS Honeywell

VALVE PRODUCTS

Now More Than Ever . . . ***YOUR BEST TURBINE***



DP single-stage turbines are rated from 10 to 1200 hp, 1000 to 5000 rpm



Type

DP

Since the introduction of the DP turbine, more than two years ago, General Electric has been telling mechanical-drive turbine users that their best turbine buy was a *standard* design, wherever it could be properly applied. Nowadays, with the emphasis on increased output, the advantages which turbine standardization offers are even more important.

Standardization means that turbines of different rating and size have mostly identical construction features. This speeds delivery, cuts manufacturing costs, makes possible a better design and a better turbine. If you're not familiar with the General Electric DP, we suggest that you contact your nearest G-E sales office or send for a copy of bulletin GEA-

4955, "A New Standard in Mechanical Drive Turbines." Write to *Apparatus Dept., General Electric Company, Schenectady, N. Y.*

GREATER RELIABILITY

From its totally enclosed governor to its durable babbitt-faced bearings, General Electric's DP turbine is built to provide greater productivity through greater reliability. Standardization has made possible "extras" such as pressure lubrication, Monel-sprayed shaft, self-positioning packings, a totally enclosed hydraulic governor. You can count on your DP for safe, dependable service in hazardous atmospheres and on tough, continuous-process assignments.

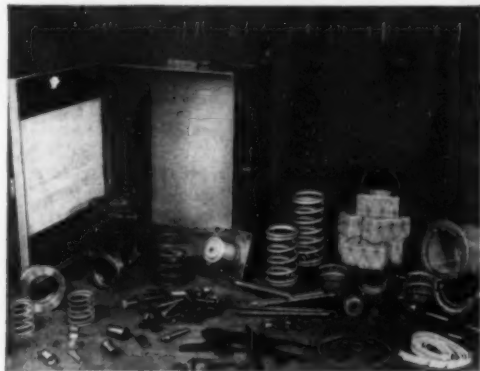
DRIVE IS A STANDARD



This DP drives a centrifugal pump in a refinery

WIDE APPLICATION FLEXIBILITY

In plants which require shifting of equipment from job to job, a standard DP frequently eliminates the need for extra drives. Because most parts are identical for all ratings, speed range and shaft horsepower can be easily and economically changed to fit new conditions. Though the DP's 30% adjustable speed range is usually adequate, a new range can be set anywhere from 800 to 5000 rpm simply by substituting a new emergency governor and governor gears. A change in horsepower rating usually requires a new nozzle plate and a few valve parts. These parts are all available on immediate delivery and save the expense of a new turbine which would be required with a less flexible, non-standard unit.



Standard spare parts kits are available with all DP turbines

EASIER, QUICKER MAINTENANCE

Because most parts of standard DP's are interchangeable on all models, spares can be easily stocked, and maintenance work handled quicker. You can have delivered with the turbine a 91-item spare parts kit, sufficient to service several machines. Socket-head cap screws are used throughout for quick disassembly. Standard shaft height, keyways, and coupling fits simplify installation. You can move DP's from job to job without change in the base structure.

GENERAL



ELECTRIC

252-49



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V A L V E S
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U.S.I. CHEMICAL NEWS

April ★ A Monthly Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1951

Stainless Steel Hardened By Liquid Nitrogen Is More Versatile

A newly developed process is said to render stainless steel some 100 per cent harder than normal and to make it a far more versatile metal. The process involves heating the steel for a short time at about 2100° F., quenching in water, cooling to -300° F. in liquid nitrogen, rolling at that temperature from 1/4 inch down to 1/16 inch, and then aging at 750° F. for several hours. This combination of treatments reportedly produced not only great hardness but also increased tensile strength, yield stress, proportional limit, torsional yield stress, and fatigue strength.

One sample is claimed to have differed slightly in composition from the others. Its wear-resistance was described as equal to or greater than that of the best wear-resisting metal combinations known. This result has not yet been fully investigated, but if this characteristic can be reproduced, it should permit a great increase in the possible applications of stainless steel.

New Simplified Test For Water Hardness

A new method for determining hardness of water is based on a simple titration and is described as faster and more accurate than the older soap test. The titrating reagent in the new test is a standardized solution of disodium ethylene diamine tetraacetate, which reacts with calcium and magnesium to form soluble un-ionized complexes. A hardness indicator that is red in the presence of calcium and magnesium ions and blue in their absence gives the endpoint of the titration. Each milliliter of reagent used equals 20 parts per million of total hardness as calcium carbonate when a 50 milliliter sample is used.

Antibiotic Handbook

A manual has just been published which attempts to digest and correlate in a single book all the essential information on the numerous antibiotics isolated and studied to date and to organize them in ready-reference form. The new handbook gives methods of production, chemistry, toxicology, pharmacology, bacteriology, and related information. Bibliographies are all up to date to 1950 and thorough indexes to micro-organisms and antibiotics formed are included. Antibiotics are treated in alphabetical order.

New Resorcinol Assay Cuts Time and Error

Tedious water extraction of resorcinol in paste and ointments can be eliminated by extracting the pastes with hydrochloric acid and ether, according to a government scientist's report. The scientist points out that in extracting a strong resorcinol paste with hot water, the filter becomes clogged so that filtration usually takes several hours.

Coatings Produced With Aroflint Are Finding Many Specialty Uses

**AROFLINT Coatings Combine Hardness, Chemical Resistance
— Are Ideal for Floors, Furniture, Many Industrial Uses**

AROFLINT 131, a room temperature curing phenolic-type resin introduced last November by U.S.I., is finding important applications because of the unique combination of properties it imparts to clear wood finishes. It makes

possible the production of air-dry coatings that parallel phenolic molding resins in hardness, toughness, and resistance to solvents, chemicals, water, and heat.

Widening Circle of Uses

Coatings made with AROFLINT are al-



Effect of nail polish on panels coated with conventional furniture finish and with a coating made with AROFLINT. Conventional finish (panel on the right in each photo) is permanently damaged, while AROFLINT coating (on the left in each photo) is unaffected.

ready finding use on home furniture and floors; bars; industrial equipment such as textile bobbins and shoe lasts; and specialties — salad bowls for example. AROFLINT coatings are now under serious consideration for commercial use on office, school, and hotel furniture; sporting equipment; marine finishes; tool handles, hat forms, industrial equipment; gymnasium floors; and similar applications.

New Catalyst Improves Stability, Adhesion

Since AROFLINT's original introduction, development work has continued in an attempt to adapt it for still further uses. The result has been the introduction of a new catalyst for use with AROFLINT which imparts two distinct advantages. (AROFLINT is cured or dried by catalytic action, the catalyst inducing condensation and polymerization of the resin.) The new catalyst, known as U.S.I. Accelerator FX 134, permits formulation of a far more stable material since mixtures of the resin solution with FX 134 have a stability of 30-60 days, as compared to only four or five days with the originally recommended catalyst.

Potential Uses in Metal Coatings

The new catalyst also improves the properties of AROFLINT coatings on metal,

MORE

Methionine Melting Point No Criterion of Purity

The chemical literature^{1,2} indicates that amino acids as a class exhibit no sharp melting points because of their thermal instability at high temperatures, and methionine is no exception to this general behaviour. This important essential amino acid has no true melting point, but is decomposed by heat over a range of temperature which is entirely dependent on the conditions of the melting point determination. For example, when a highly purified sample of methionine is heated at the rate of 3°C. per minute, starting at 20°C., the decomposition point was found to be 262°-262.5°C. When heated at the same rate, but this time starting at 260°C., the same sample was found to decompose at 271.6°-271.9°C. The decomposition point of the same sample varied from approximately 262°C. to 272°C., depending on the length of time the sample was in the heating bath. The conclusion is that the apparent melting point of methionine varies widely according to the conditions of heating and is of little use either for identification of this substance, or as a criterion of its purity.

(1) Taylor and Baker, "Hidgwick's Organic Chemistry of Nitrogen," Oxford Press, New Edition, p. 165.
(2) Mariner and Fuson, "The Systematic Identification of Organic Compounds," John Wiley and Sons, 2nd Edition (1948), p. 161.

New Drug for Peptic Ulcer

A new drug, claimed to have brought healing and caused disappearance of ulcers often in a matter of weeks, is being hailed for its promise of relief for ulcer patients who do not respond to conventional therapy. The drug, based on studies showing that female ulcer patients generally become free of symptoms during pregnancy, represents a fundamentally new approach to treatment of peptic ulcer. Studies have failed to reveal any undesirable side effects, according to researchers. Out of 16 patients given the drug after 15 weeks of unsuccessful conventional treatment, 15 are claimed to have become free of symptoms in four to six weeks.

April

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U.S.I. CHEMICAL NEWS

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1951

High Speed, Automatic X-Ray Inspection Of Industrial Products

A new industrial X-ray development is expected to make possible high-speed, automatic inspection of thousands of industrial products. Core of the new inspection apparatus is a tiny crystal called a "semi-conductor." When excited with X-ray radiation, it acts as an amplifier tube. The crystals reportedly amplify the energy they receive one million times. On an area-for-area basis, they are over a million times more sensitive to X-rays than are the ionization chambers commonly used to measure X-ray radiation, and more than one thousand times more sensitive than photo-electric cells like those used in "electric-eye" applications.

Acrylic Dental Fillings

A catalytic method for polymerizing acrylic resins at low temperatures to make possible their use as dental fillings was described at a recent scientific meeting. Advantages claimed for these resins are that they can be made to match tooth color quite readily, are comparatively inert in oral fluids, and may be inserted quickly and easily into tooth cavities. Government researchers are continuing work to overcome several disadvantages, which include a larger shrinkage than direct filling materials, color changes, and the release of heat during polymerization in the tooth.

CONTINUED

Aroflint

Coatings

since it imparts better adhesion to metallic surfaces, so that AROFLINT now has many potential uses in metal coatings as well as in wood finishes. Coatings catalyzed with the new FX 134 have been found useful for numerous special applications on rigid metal surfaces. AROFLINT 131 without catalyst can also be utilized as a baking finish on metal in the production of chemical- and solvent-resistant coatings for tanks, drums, and similar applications.

Aluminum Oxide Lab Ware Is Strong, Non-Porous, Resistant to Corrosion

Development of a successful process for making crucibles and other laboratory ware from aluminum oxide has been reported. The crucibles are said to be 99.8 per cent pure, strong, and of a transparency rivaling that of fine china. They will not break when dropped from a height of several feet and are non-porous, highly resistant to corrosion, and not subject to chemically-induced changes.

The material reportedly has a compressive strength of about 500,000 pounds per square inch which it retains up to about 2000°F. It is expected to be useful in applications involving the high temperatures necessary to melt super-hard metals. One possible use for the material is as an alloy in making cutting tools to machine super-hard metals. Another possibility, for use in jet aircraft parts subject to high temperatures, is mixing metal and the aluminum oxide ceramics.

Shirtsleeve Chemistry — Linen from Seed Flax

A new chemical retting process may make it possible to increase world production of both linen and linseed oil without increasing acreage of flax. Nearly all the linen produced now comes from flax grown specifically for that purpose—flax pulled while still green, before much lignin has developed in the stems. Flax grown for seed is allowed to mature and the straw discarded as waste because, with its high lignin content, retting it for producing linen was considered impossible.

In the new process, ripened seed-flax straw is subjected to decortication in a special machine under controlled humidity. The resulting material is made into a roving which is chemically retted by dilute solutions of alkaline sodium hydrosulfite under controlled pH, temperature, and concentration. The product is washed and spun wet to yield high grade linen yarn which tests indicate is as good as imported linen.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

"Shock-treating" liquids and solids in liquid suspension with a new "mill" in which a high speed circular saw strikes a jet of liquid is said to modify properties of slurries, change viscosity of solutions, affect degree of polymerization, and speed up reaction rates. (No. 868)

For fast, precise, automatic determination of moisture in ether, alcohol, acetone, benzene, chlorinated hydrocarbons, and most solvents, and in solids, a new instrument is on the market. (No. 870)

A chemists-type fabric, said to look, feel, and absorb water like natural chambray yet cost 1/3 as much, reportedly withstands gasoline, grease, and powerful detergents. It can be used to clean walls, floors, mirrors, windows, tile, and cutlery. (No. 871)

A new phenolic resin for hot-press plywood gluing is claimed to produce glue lines passing government military specifications. (No. 872)

For high precision measurements of dry thickness of non-electrical conductive coatings and other sheet-like materials (including aluminum and other non-ferrous metals), a new instrument is available. (No. 873)

For adhering polyvinyl chloride finishes to rusty steel, a new primer is said to reduce "creep" from rusted surfaces to a small fraction of that with regular primers. (No. 874)

A new service for plants using instrument tubing or fluid transmission lines subject to moisture or corrosive atmospheres involves extruding a chip-proof, corrosion-resistant vinyl or polyethylene coating over the customers' tubing. (No. 875)

A new low-cost, spray-type deodorant for household use is claimed to electrostatically precipitate, absorb, and "wash" away odors and smoke. (No. 876)

An extra high heat resistant aluminum paint (silicone-based) fuses with surface metal immediately on application, withstanding temperatures up to 1,700°F., and forms a bright, elastic finish resistant to moisture, corrosion, mild acids, alkalis and industrial fumes, according to the makers. (No. 877)

A new antistatic and cleaning agent for methyl methacrylate moldings, sheets, etc., is described as an inexpensive, highly effective, fast-drying, easy-to-apply liquid. (No. 878)

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U.S.I.

BRANCHES IN ALL PRINCIPAL CITIES

We Must Pay As We Go

We must do our utmost to pay as we go for our present defense program.

On that proposition those who speak with authority are remarkably well agreed. This editorial — the second in a series on our mobilization for freedom — sets forth in simple terms why there is this agreement.

Next year — the fiscal year beginning next July 1 — the federal government's budget calls for the expenditure of \$10 billion more than is scheduled to be collected in taxes. The deficit is due to the increase in defense expenditures.

A part of this deficit can be eliminated by cutting non-essential expenditures and increasing efficiency in the defense program. There is wide agreement on this. It is the duty of the President and Congress to see that it is saved.

How the remaining deficit anticipated in the federal budget—\$5 billion to \$10 billion—is handled is crucial. The government can meet it by raising taxes—by paying as we go. Or it can borrow, issuing more government bonds.

Borrow Again?

We relied heavily on borrowing in both World War I and World War II. In World War I only about one-third of the expenditures of the federal government were met by taxation. In World War II about 45 percent were met in this way. The rest we borrowed. Some people ask, why can't we rely heavily on borrowing again? Why is it crucially important to avoid adding \$5 billion to \$10 billion to a federal debt that is already \$257 billion?

Part of the answer is found in the contrast be-

tween this defense program and our all-out effort of World War II. Another part—and one that is all-important in combatting inflation—results from the rapid decline in the purchasing power of the American dollar in recent years.

We went "all out" in World War II. We put almost half of everything we produced into our military effort. Taxes high enough to pay the financial costs as incurred would have meant huge tax increases. It was feared that such increases would kill financial incentives to get "all out" production. Since we expected the war to be short, borrowing seemed a safe expedient. Price control and rationing, with wartime patriotism to give them effective support, were relied upon to keep in check the inflationary pressure created by borrowing rather than taxing.

Our present defense program is scheduled to take a much smaller share of our production, but to take it over a much longer period. At its peak, the program as now planned will take only about 20 percent of our total national production. But, to use General Bradley's phrase, "the conditions under which we labor may persist for ten, fifteen and twenty years."

What About Controls?

For a period of any such duration it would be foolhardy to expect that the sort of controls we had for the few years of World War II could hold in check the inflationary pressure created by not paying as we go. It would be as foolhardy as it would be for a family to plan on borrowing to pay the expenses of a member discovered to be afflicted by a chronic ailment which might last a long lifetime.

Obviously, the only safe thing to do in such a case would be to adjust the family budget so that the expenses of the illness would be paid currently.

Our heavy reliance on borrowing in World War II had consequences which block a successful repeat performance.

If the borrowing had been done by persuading individuals to transfer their savings into government bonds, relatively little inflationary pressure would have been created. What the government would have spent with the proceeds of such bond sales would have been subtracted from the money individual consumers could spend.

But most of the borrowing was done from banks. That course expanded the amount of money available to the government without any offsetting subtraction of money from the hands of individuals. Thus, when direct price controls were removed after the war, this bottled-up purchasing power contributed to a price inflation which has cut purchasing power of the American dollar about in half — and decidedly changed the attitudes of the American people toward that dollar.

During World War II, Americans in general believed that:

The war would not last long.

The dollar would hold its value, and even gain value after the war.

Many wonderful new products would be available in the postwar period.

Today the American people have:

Seen the value of their dollars melt away fast.

Been assured that, at best, we may have a 10-15-20-year pull ahead.

Been warned not to expect a postwar paradise anytime soon.

One result of these changed attitudes is a notable lack of enthusiasm for government bonds on the part of individual investors. This is indicated by the fact that since Korea redemptions of E bonds have exceeded sales by about \$600 million. Another result is a continuing rush to convert dollars into physical goods and equipment or claims on them. This trend weighs against financing the prospective federal deficit by borrowing from individuals.

Borrowing from banks to meet the deficit would again add fuel to inflation.

The prospective deficit is due to federal expen-

ditures for military goods. Even if they are not blown up or shipped abroad, these goods will not be available to civilians. But the money paid to those who produce military goods will still be available to bid up the prices of civilian goods. Thus, at a time when people show relatively little disposition to save dollars, a menacing inflationary pressure — an inflationary gap, the economists call it — will be created.

If our fight against inflation is to be successful this gap must be closed by taxes. We need to do other things, too, for inflation has many different causes. Credit expansion must be effectively controlled. Production of civilian goods must be increased as much as possible by eliminating waste and inefficiency. But a pay-as-we-go tax program is basic to a successful attack on inflation. And inflation — unless it is checked — could wreck our defense effort.

We cannot pay as we go merely by soaking harder the corporations and those in the upper income brackets.

As the President's Council of Economic Advisers has reported, "by far the largest part of the additional revenue must come from the middle and lower tax brackets. These are the brackets in which the great bulk of the income is located."

Taxes Can Attack Inflation

By spreading tax increases broadly, taking small amounts from many people, inflationary pressure would be effectively reduced. It is the expenditures of the great mass of people, rather than the small numbers in the upper income tax brackets, that create most of the pressure. Moreover, it is possible to increase taxes broadly without killing the economic incentives to produce. Maintaining these incentives is essential to the success of the defense effort.

Our elected representatives cannot be expected to be enthusiastic about a pay-as-we-go tax program. It involves increasing the taxes of the great body of their constituents, an operation completely lacking in political glamour. However, such a program also involves the integrity of the American dollar. And that is absolutely essential to the success of the defense program. We shall be very foolish if we do not let our leaders know that we want them to do everything possible to pay as we go.

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Ploweld can also be used to combat abrasion

7 REASONS WHY THE G.T.M. SPECIFIES **PLIOWELD**

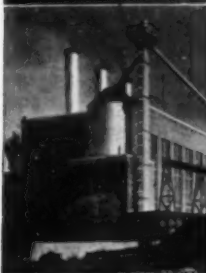
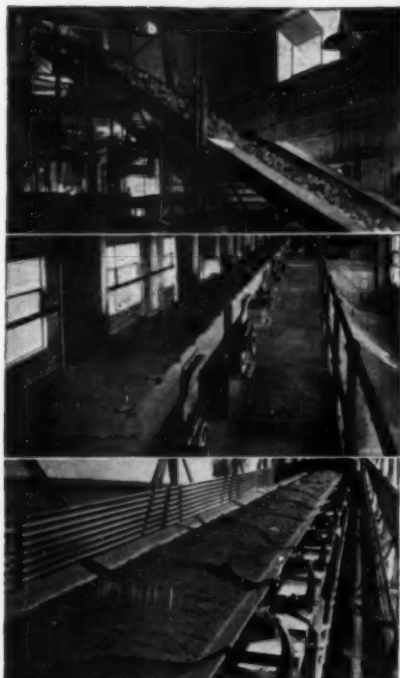
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Processing and
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HORTONSPHERES

naturally right for storing your volatile chemicals

Everything about the Hortonsphere—its shape, its accessories, its easy upkeep — makes it a natural for storing volatile chemicals with vapor pressures higher than atmospheric.

Such chemicals must be stored *under pressure* — or large quantities would escape in gaseous form during storage. The Hortonsphere not only applies this basic principle — it does so with greater overall efficiency than any other type of high pressure container.

Consider, for instance, the amount of steel required to build a sphere. The spherical shape resists internal pressure better than any other shape. Because of this fact, it takes less steel to build a Hortonsphere.

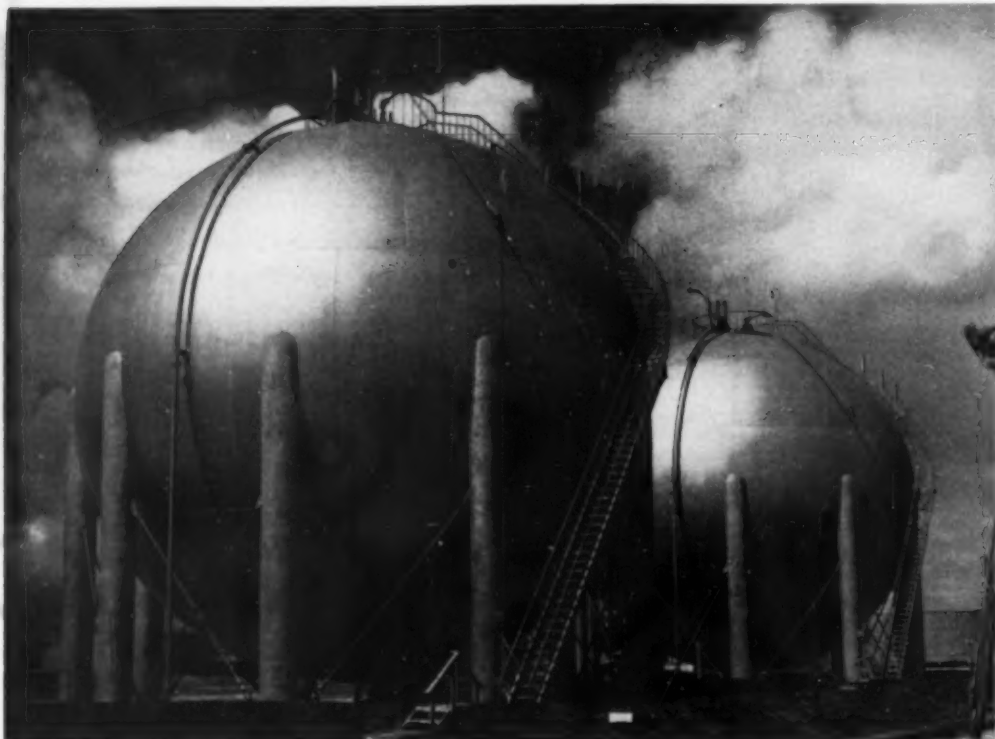
The Hortonsphere doesn't require a multitude of accessories. It needs only one set of pipe connec-

tions and fittings. Contrast that with the manifold- ing needed for several smaller tanks of the same total capacity.

It's easy to inspect and maintain a Hortonsphere — for the entire structure is supported above ground on columns. Also, it is more economical to paint and insulate since it has less surface area per barrel of capacity.

Bulletin F tells more about the "naturally right" tank for volatile chemicals — the Hortonsphere. Write our nearest office for a copy.

Below: Two 10,000-bbl. Hortonspheres at the Shell Oil Company's Dominguez, Calif., refinery. They are designed for a working pressure of 75 lbs. per sq. in. and are used to store butane.



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IT TAKES A LOT OF COLD CHILLS

To drape a *Lady* with a *Log*

Wood pulp to synthetic fabrics is no trick. But in a new hush-hush variation of the cupro-ammonium process, exothermic heat generated in reducing wood pulp must be *evenly* dissipated.

That's where York steps in. With York FlakIce Machines giving birth to tons and tons of non-revealing ribbons of FlakIce. They freely circulate throughout the mix . . . providing a quick, uniform temperature reduction.



**YORK
FLAKICE
MACHINE**
MODEL DER-130

York FlakIce Machines range in capacity from 1 to 28 tons of ice per day. Stainless steel freezing drum and cutter, automatic "no hands" operation (from flowing water to cascading flakes of ice), assure positive sanitation. Automatic controls and built-in safety features assure high efficiency and trouble-free maintenance.

Wherever you find the need for crushed or sized ice, there you'll find York FlakIce Machines . . . from chemical processing to sausage making or concrete cooling in dam construction. For free facts, get in touch with your York Representative or write York Corporation, York, Pennsylvania.



FLAKICE RIBBONS COST LESS COOL QUICKER — SAVE TIME

FlakIce Ribbons are superior to cracked or crushed ice. Cost less than bulk ice and eliminate crushing or handling. Fragile brittleness prevents damage to agitator blades or mixing devices. The large ratio of surface to weight of each ribbon gives extra rapid heat reduction of liquids and compounds.



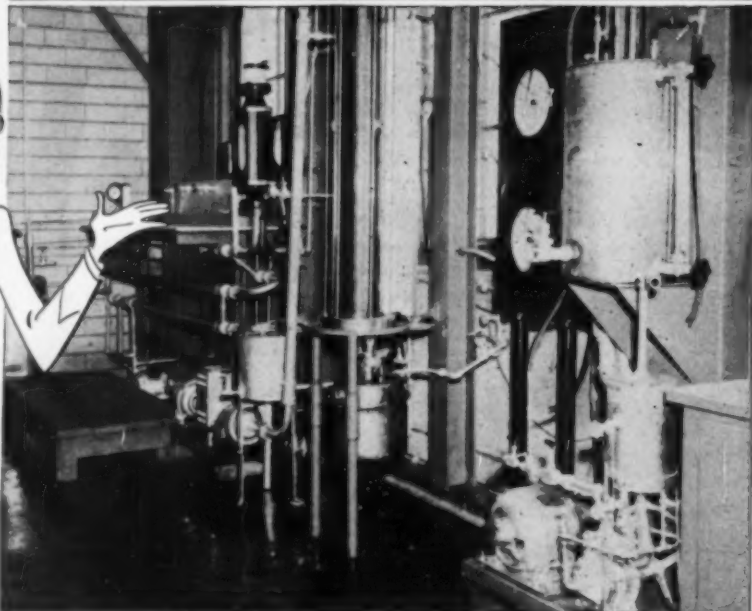
The big advances come from

YORK

Headquarters for — **Refrigeration and Air Conditioning**

The Struthers Wells Crystallization Laboratory

is at your service!



Struthers Wells Laboratory Unit is Available for Use in Studying Your Crystallization Problems

The Struthers Wells laboratory unit—employing the same basic principles of crystallization as featured in our Krystal crystallizers—is available for your use in studying your crystallization problems. Made of 316 stainless steel and pyrex glass, the equipment can handle a wide variety of corrosive materials.

Illustrated above is the pyrex glass suspension container with salt trap, heater (or cooler), instrument panel and vacuum pump. The vaporizer (not shown) is mounted above the suspension container.

Here are examples of a few types of crystallization performed in our laboratory:

1. Crystallization of salts having an inverted solubility. (Anhydrous sodium sulphate, gypsum)
2. Crystallization of salts having a slight increase in solubility with increase in temperature. (Sodium chloride)
3. Crystallization of salts having a substantial increase in solubility with increase in temperature. (Copperas, sodium nitrate)

Why not take advantage of our laboratory facilities and get the answer to your crystallization problems.

WRITE FOR BULLETIN 50-A



*Ask about our Consultation
and
Laboratory Testing Service*

STRUTHERS WELLS CORPORATION

Crystallizer Department . . . Warren, Pa.

PLANTS AT WARREN, PA. • TITUSVILLE, PA.

OFFICES IN PRINCIPAL CITIES

Announcing

CRYSTALLINE

VITAMIN A ACETATE

available in stabilized, high potency, dry granular form and as a liquid palmitate derivative

For the first time in history, crystalline Vitamin A, has been produced by synthesis on a commercial scale.

No longer is it necessary to tolerate the extraneous materials found in previous natural and synthetic products. All the important advantages of the pure crystalline material are now available in unrestricted volume in these new Pfizer products.

STABILIZED CRYSTALLINE VITAMIN A ACETATE

A dry product of exceptional stability which can be handled, measured and stored under all normal conditions. Insensitive to oxidation or humidity, Stabilized Crystalline Vitamin A Acetate fills a long felt need for a dry, high-potency product which can be used in the manufacture of Vitamin A tablets, in the fortification of foods and in the preparation of other dry products, without fear of deterioration.

VITAMIN A PALMITATE

Derived from pure Crystalline Vitamin A Acetate, the outstanding purity and high potency of this product make it ideal for use in oil solutions and aqueous dispersions. It is also particularly suited to the fortification of milk and other liquid food products where taste is a factor. Excellent stability.

WRITE OR PHONE FOR COMPLETE DETAILS

These new Crystalline Vitamin A derivatives make possible higher quality products than ever before attainable and open the way for many new applications. Write for samples, prices and technical data.



STABILIZED CRYSTALLINE VITAMIN A ACETATE

Physical Characteristics—Finely divided dry powder, light yellow color, practically odorless and tasteless.

Potency—50% dissolved at 300,000 U.S.P. units per gram.

Purity—Derived from Crystalline Vitamin A Acetate, the only pure form of Vitamin A commercially produced.

Packaging—Packaged in standard amber glass, screw type bottles and in drums.

VITAMIN A PALMITATE

Physical Characteristics—Liquid—yellow color, practically odorless and tasteless.

Potency—Not less than 1,000,000 U.S.P. units per gram.

Purity—Derived from pure Crystalline Vitamin A Acetate, it has a purity of 99.9%.

Packaging—Packed in aluminum bottles under nitrogen.

Also available in oil solution at a potency of 1,000,000 U.S.P. units per gram.



MAIL COUPON FOR TECHNICAL DATA

Elm. Pfizer & Co., Inc., 630 Park Ave., New York 17, N.Y.
Kindly send me Technical Data on Crystalline Vitamin A

Company.....

Address.....

Type of Business.....

Interested in Vitamin A for.....

Signed by..... Position.....

Increase production — Cut Costs

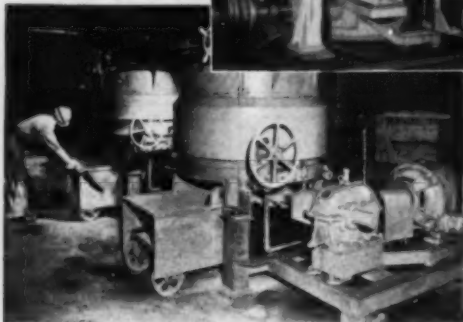
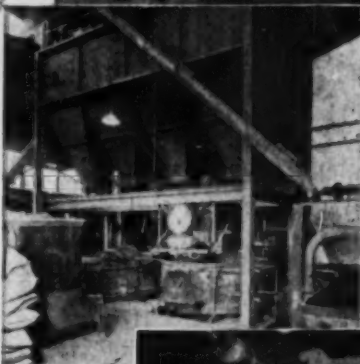
7 TYPICAL INSTALLATIONS giving daily proof of Better Performance

AT a time when industry is committed to its greatest effort, modern high-production equipment is vitally important. The seven Simpson Mix-Muller installations shown are representative of the way in which these high capacity machines serve the chemical-process industries.

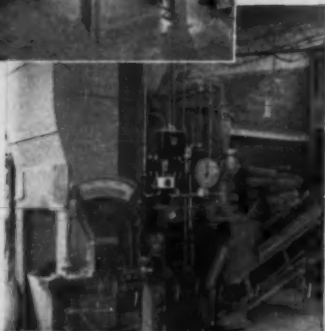
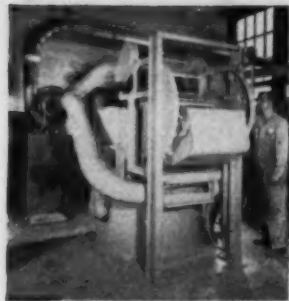
Here are carefully engineered mixers that have been proved superior in over 5,000 installations. Day-in and day-out operation has shown that blending is more accurate and thorough — the mixing cycle is shorter — and the cost per batch is considerably less, than in older mixing methods. Whether dry, semi-plastic, or plastic material is to be blended — the result is the same. That's because Simpson Mix-Mullers embody the *true mulling* principle of mixing.

THE MULLING PRINCIPLE OF MIXING

The thorough mulling of Simpson Mix-Mullers is similar to the rubbing, kneading and smearing action of a mortar and pestle. The machine consists of a circular stationary pan, in which is mounted a special combination of mullers and plows that revolve. The mullers are adjustable and are supported on rocker arms so that they are free to ride on the material, creating pressure and an intensive rubbing and smearing action as they revolve. This eliminates any balling of material and quickly develops a maximum plasticity of the mix. No other method has ever proved more effective for fast, thorough, controlled mixing and blending.



with **SIMPSON Mix-Mullers**



MAKE THIS SIMPLE *Smear Test* **YOURSELF**

Place a small amount of the product you are now mixing on a ground glass and run a spatula through the center of the mass. If the batch is not thoroughly mixed and blended — you will find tell-tale lumps or smears which ordinary examination would not reveal.

The above illustration shows the actual result of a test on a product in which thorough mixing was very important. Notice the absence of blotches in the upper smear . . . the result of *mulling* in a Simpson Mix-Muller.

This thorough controlled mixing plus speedier, lower cost operation are ample reasons for deciding on Simpson Mix-Mullers.

Simpson Mix-Mullers are built in capacities ranging from 1/10 to 30 cu. ft. They may be specially equipped for heating or cooling while mixing — for mixing under vacuum or pressure — for corrosive materials — or to function as a reaction vessel.

Write for complete details covering the use of Simpson Mix-Mullers to meet your individual requirements . . . or send for a copy of our latest Chemical-Process Mixing Catalog.



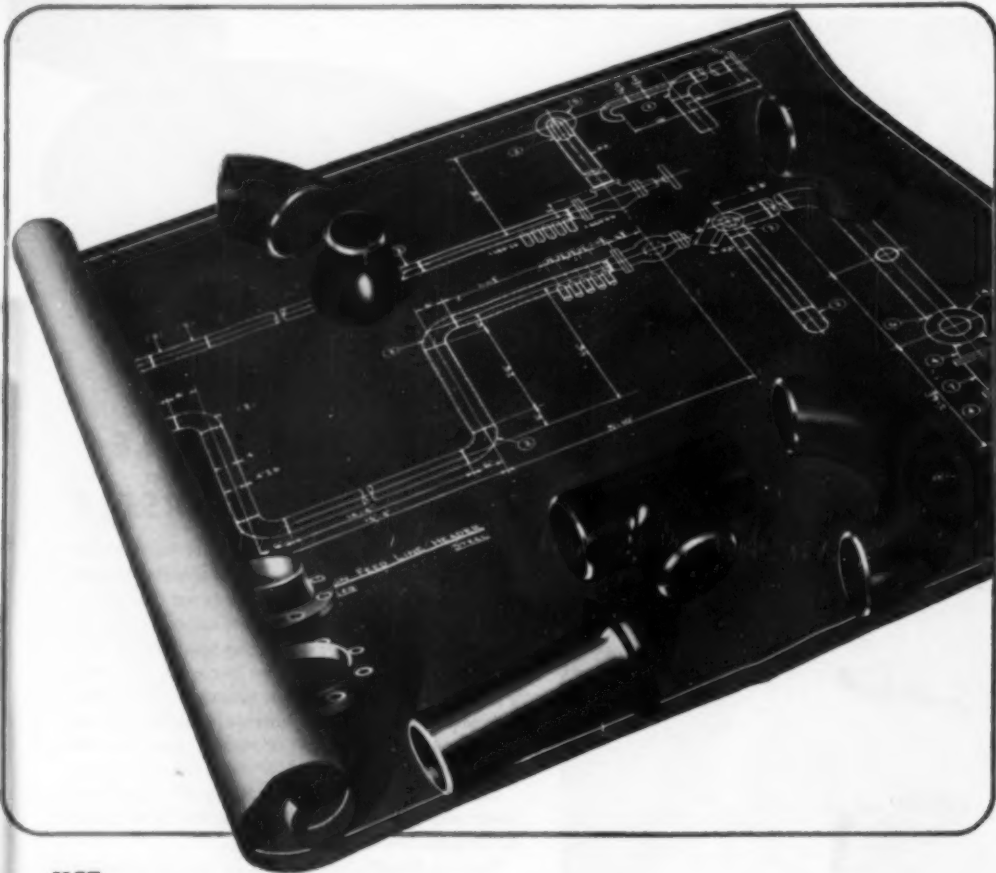
SIMPSON Mix-Muller® Division

NATIONAL ENGINEERING CO.

604 Machine Hall Bldg., Chicago 6, Ill.



TO DO A BETTER PIPING JOB . . .



USE . . .

GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

When you specify and use Globe Welding Fittings you have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication.

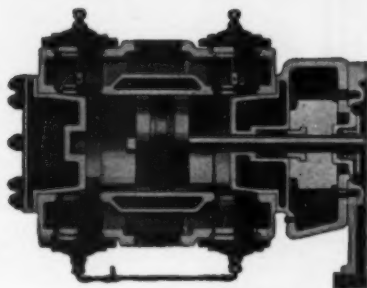
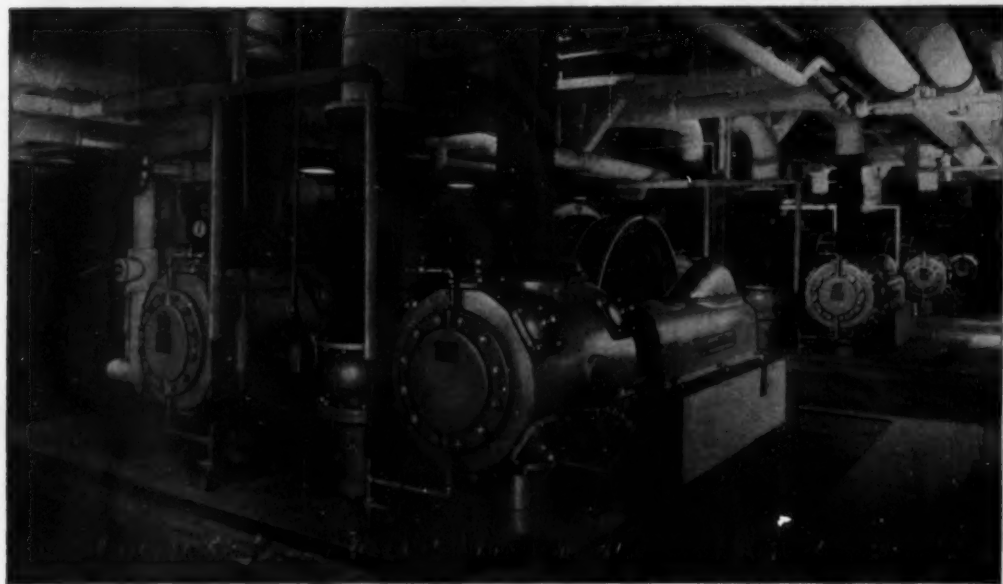
GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin
Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia
St. Louis • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.



Send for the Globe Welding Fittings Catalog—and look to Globe as a preferred source of supply.

PRODUCTION OF CHLOROMYCETIN DEMANDS STERILE AIR



Advantages of Ingersoll-Rand "NL" Cylinders

The Ingersoll-Rand "NL" cylinder achieves oil-free compression without the use of tail rods or secondary crossheads. The weight of the piston is supported by graphitic-carbon wearing rings which prevent metallic contact between the piston and the honed cylinder bore. Compression rings are also carbon...metallic inner expanding rings giving the proper wall pressure. Because the carbon rings are self-lubricating, the need for any conventional lubricant is completely eliminated. Wearing rings can be adjusted to maintain the proper clearances.

Four Ingersoll-Rand "NL" Compressors Supply Air for Mold Growth in Parke, Davis & Co. Plant

In its Detroit plant, Parke, Davis & Co. is producing Chloromycetin by both biological and synthetic processes. The biological method includes an air-activated fermentation process that must be free from any contamination.

Air for activating the mold growth is compressed to about 40 psig by four Ingersoll-Rand XRE electric-driven compressors. Since any oil or other lubricant used in the compressor cylinders would contaminate this air, the compressors are fitted with Ingersoll-Rand "NL" non-lubricated cylinders. Other precautions to assure sterile, contamination-free air to the fermentation tanks include electrostatic filters on the compressor intake, moisture-removing after-coolers, and stainless-steel mesh and carbon sterilizing filters.

For such services demanding oil-free air or gas, Ingersoll-Rand builds standard lines of compressors fitted with "NL" non-lubricated cylinders. Sizes range up to 300 hp for handling air or any gas up to a discharge pressure of 2500 psi. Consult Ingersoll-Rand engineers on how you can use "NL" compressors for your process or instrument-control.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

587-1



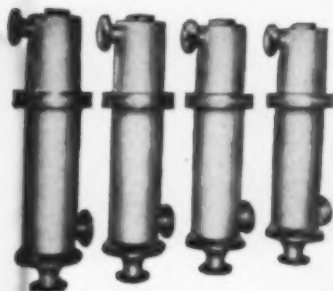
Pipe Fittings — Ampco pipe fittings are available in all sizes . . . elbows, tees, crosses, reducing fittings and flanges . . . forged, wrought, fabricated or cast — with flanged, welding or screwed ends . . . schedule 10 through schedule 180.



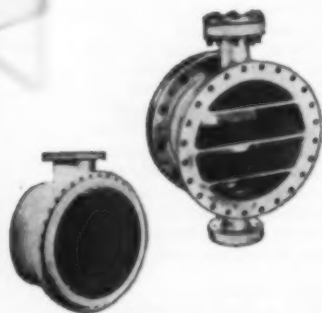
Process Pipe . . . Prefabricated
Ampco alloys selected for resistance to corrosive action of waste liquors. Prefabricated at Milwaukee from centrifugally cast sections, including flanges. Ampco pipe is also available in extruded seamless IPS up to 4" and in larger diameters welded automatically from Grade 8 plate.



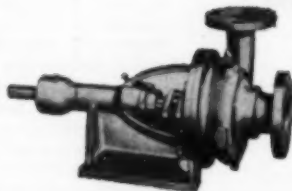
Conveyors . . . Sulphuric Acid Service — Ampco alloys selected for top resistance to erosion, corrosion and abrasion for conveyors handling bulk materials saturated with 10% H₂SO₄ at 210° F. Entire assembly — flights, troughs, shafts, buckets, chain, bearings, etc. — fabricated from Ampco alloys with matching Ampco-Trode electrodes.



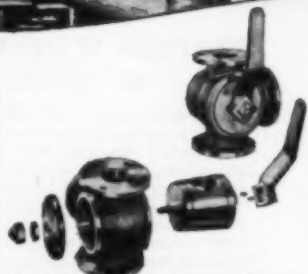
Barometric Condensers and Jet Ejectors — Ampco alloys selected for high strength, corrosion resistance and ability to withstand high-velocity impingement. Sand-cast venturi welded with Ampco-Trode to centrifugally cast body.



Heat Exchangers — Shown above are typical Ampco fabricated exchanger heads. Complete exchangers including tube sheets, tubing, heads and shells made from corrosion-resistant Ampco alloys are available through the fabricator of your choice.



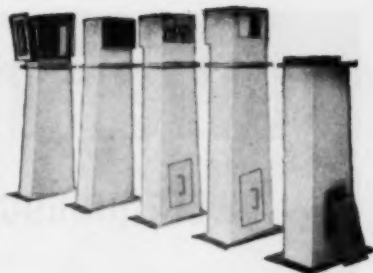
Ampco Centrifugal Pumps — Here — for the first time in pump manufacturing history — is a "production-built" and "production-priced" pump to handle acids, salts, alkalis, and other corrosive agents hitherto requiring specially built pumps. The Ampco single stage, single suction centrifugal pump offers long life, high efficiency and low maintenance costs through the combination of correct design and properly selected materials.



Corrosion-Resistant Ampco Plug Valves — Made of properly mated Ampco alloys to combine operating efficiency with extremely long life — under the most severe conditions of corrosion, erosion, cavitation, and abrasion. No pockets to trap corrosive liquid. Available from 1/2 inch up to any desired pressure, in straight-through (2-way) or 3-way, lubricated or non-lubricated types.



Fractionating Tower...Acetic Acid
— Ampco alloys selected for resistance to corrosion by acetic and formic acids . . . and for maximum retention of physicals at temperatures up to 500° F. Fabricated of corrosion-resistant Ampco alloys throughout . . . deep-drawn sheet, plate, extruded tubing, centrifugal castings, etc. . . . welded with Ampco-Trode 180 electrodes.



Chutes . . . Potash Production
— Ampco alloys selected to resist the severe erosive and corrosive effects of the mixture being carried. Fabricated of 1/4" thick corrosion-resistant Ampco 8 plate welded with Ampco-Trode 180 electrodes. No pre-heating or post-heating was required. The weld joints match the parent-metal in chemical and physical properties.

AMPCO

Resist Corrosion, Reduce Costs

...with this unique combination of money-saving properties:

1. High resistance to corrosion
2. High tensile strength
3. High physicals at extreme temperatures
4. High weight to strength ratio
5. High impact and fatigue values
6. High wear-resistance — to erosion — corrosion, cavitation, etc.
7. High compressive strength
8. High modulus of elasticity

The long service life of Ampco Bronze Alloys — at a moderate initial cost — offers unusual savings to both designers and plant engineers.

Reduced material failures mean (a) minimum down-time (b) less production loss and (c) lower maintenance costs.

Increase efficiency of design and operation . . . specify Ampco Bronze alloys for handling corrosive and erosive media. Write today for recommendation and complete information.

Ampco aluminum bronzes are available in a number of grades to meet your exact requirements in any form you need: rolled sheet or plate, sand or centrifugal castings, forgings or extrusions . . . pipe and fittings. Also, Ampco's arc-welding electrodes, corrosion-resistant centrifugal pumps and plug valves.

Free . . .

Process Industries
Bulletin — 16 pages
of money-saving
information.

Tear out this coupon and mail today!

Ampco Metal, Inc., Dept. C-8, Milwaukee 15, Wis.
Send me your free bulletin, giving full information on the application of Ampco Alloys in the Process Industries.

Name

Company

Company Address

City State



Ampco Metal, Inc.

Milwaukee Wisconsin
West Coast Plant • Burbank, California

power modernization

lowers production costs...

with

control
of speed

A manufacturer* of food processing machinery states,

*"Speed-Trol made possible the design of a new
de-watering press which resulted in:*

- 26% greater moisture extraction ... plus corresponding savings in the reduction process ... plus perfect control of moisture content."

*(Name upon request)

STERLING SPEED-TROL

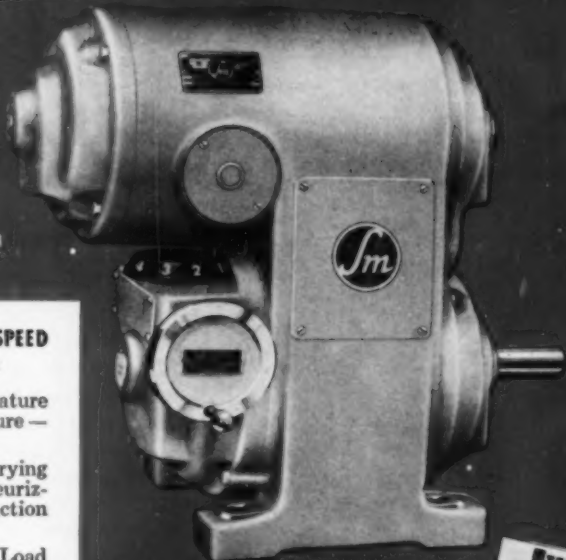
...GIVES YOU VARIABLE SPEED CONTROL NECESSARY FOR:

PROCESS CONTROL OF: Temperature
— viscosity — level — pressure —
flow — etc.

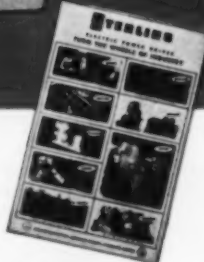
TIME CONTROL OF: Baking — drying
— heating — cooking — pasteurizing
— soaking — chemical action
— etc.

EQUIPMENT ADAPTATION TO: Load
variation — sequence synchroni-
zation. Size — tension — hardness
or shape of materials to be pro-
cessed — machined — conveyed —
blended — mixed — etc.

VARIATIONS IN: Quality — quantity
— operators' abilities — etc.




Ask for your copy of
pictorial bulletin No. C-60,
showing Sterling Electric
Power Drives Turning The
Wheels of Industry.



STERLING ELECTRIC MOTORS

Plants: New York 51, N. Y.; Los Angeles 22, California; Hamilton, Canada; Santiago, Chile.

Offices and distributors in all principal cities.



Latest Fractionation Facilities...

produce special solvents tailored to your needs

sulphur removal from Roosevelt's aliphatic naphthas means non-corrosive, chemically stable solvents, free of offensive odors . . . Flexible, Kaskade-type fractionating towers, plus constant quality-control analysis means every shipment will meet your specifications. Send us your solvent specifications today!

WRITE FOR COMPLETE INFORMATION

You'll find the special solvents produced by Roosevelt will help you produce products to meet your high-quality standards. *Complete* catalytic



ROOSEVELT

in solvent refining corp.



pointers

to

BETTER PROCESSING

EQUIPMENT INFORMATION FOR PROCESSING PLANTS

Modern "Mix" Room at General Aniline Works, Rensselaer, N. Y.

—helps streamline the production of AZO DYES in country's oldest dye plant.

Sprout-Waldron Horizontal Batch Mixers receive the dye product after it comes from grinders. Here it is "standard-



ized" by addition of shading colors and reducing agents to match dye type. After mixing operation is completed, final product batch is sent to the weigher and prepared for shipment.

It's applications such as this that have established Sprout-Waldron as headquarters for mixing equipment. Consult with Sprout-Waldron on your requirements.

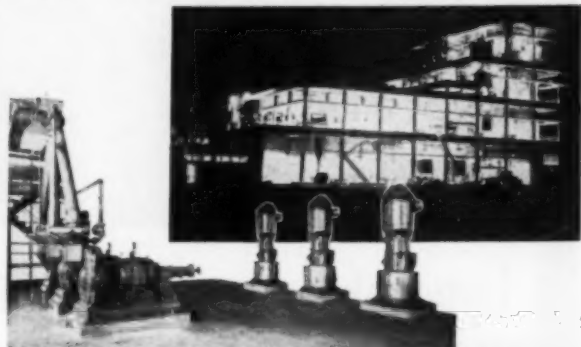
For further information about any of the equipment described, write to Sprout, Waldron & Co., Inc., 15 Waldron St., Muncy, Pa.

Sprout-Waldron
Manufacturing Engineers
SINCE 1866
MUNCY, PENNSYLVANIA

New Corn Products Plant Modernizes Starch and Sugar Production

The "Bluebonnet" plant at Corpus Christi, Tex., made headlines—not only because of its unique wall-less construction. Of even greater interest to the process industry are the much improved, continuous methods used to transform Milo Maize into starch and sugar. The engineers of Corn Products Refining Company broke with tradition—sought and found a better way to make starch!

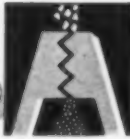
Here, the old conventional stone-type buhr mill was replaced with modern-day *degerminating mills, disintegrators, and repulpers* . . . all specially equipped for starch processing.



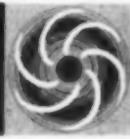
At Corpus Christi, six Sprout-Waldron 36" single disc degerminating mills handle the full plant load of incoming grain, freeing the germ from the kernel without crushing it. After separation, three disintegrators and two S-W36" double disc repulpers take over and together do a job that formerly required six buhr mills, moisture expellers, and a three-stage coarse fiber washing station to get the same results.

Engineers of the "Bluebonnet" plant point out that the use of Sprout-Waldron repulpers, in combination with disintegrators, improves the recovery of starch, decreases maintenance costs, and requires considerably less floor space than previous methods.

Why not bring your size reduction problems to Sprout-Waldron? Our broad experience may be helpful to you, too!



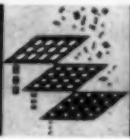
SIZE REDUCTION



MIXING & BLENDING



BULK MATERIALS HANDLING



PRODUCT CLASSIFICATION



PELLETING & CUBING

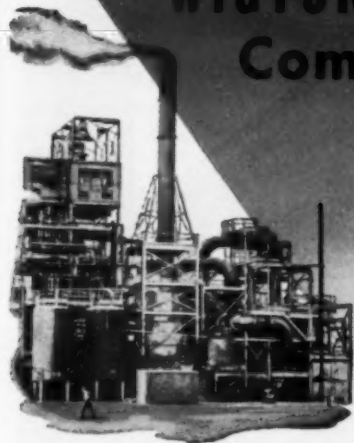
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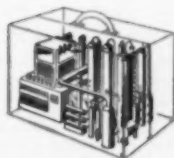
This time...

USE
WIGTON-ABBOTT'S
Complete Service

FROM
PLANNING
TO
PRODUCTION



"Packaged Plant Construction"



A service by Wigton-Abbott Corporation that broadens the definition of plant construction to include creation of the process, designing and installation of equipment, and "delivers" the complete plant, ready for operation. • To perform and to coordinate these complex functions, Wigton-Abbott Corporation employs the experience and skill of engineers and architects—including specialists in all branches of chemical, mechanical, electrical, civil and industrial engineering. The Construction Department is staffed and equipped to erect any type of industrial plant. • A Wigton-Abbott Corporation representative will be glad to consult with you on any phase of plant design and construction.

*Yours for
the asking*



"Packaged Plant Construction"
Reading time, only 10
minutes—but it will save
you many hours by an-
swering basic questions.

Wigton-Abbott Corporation

DESIGNERS...ENGINEERS...CONTRACTORS...PLAINFIELD, NEW JERSEY

Some of the functions that have been successfully performed by Sandvik Conveyors

WITH A SANDVIK WATER-BED CONVEYOR YOU CAN:



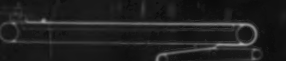
COOL AND CONVEY



REGULATE THICKNESS WHILE COOLING
(ANY THICKNESS UP TO 1" CAN BE COOLED)



CUT MATERIAL TO DESIRED SIZES
WHILE COOLING



COOL AND STRIP OFF GELATINOUS
MATERIALS IN SHEET FORM



COOL LOOSE AND PULVERIZED
MATERIALS

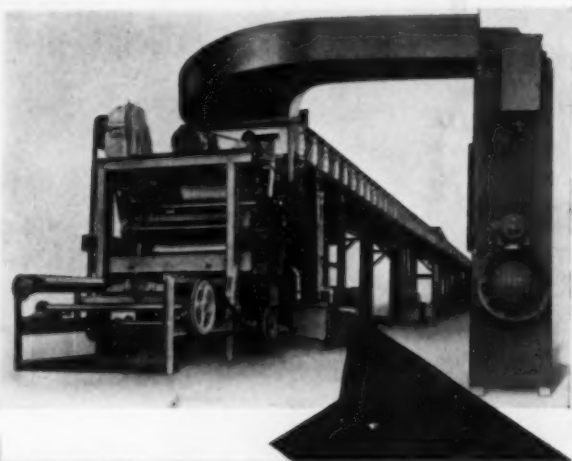


COOL SOLIDS IN SHEET FORM



COOL MATERIAL IN LAYERS

HOW CAN SANDVIK'S NEW COOLING CONVEYOR Improve YOUR production?



This Sandvik Patented Water-Bed conveyor handles gelatin from liquid form to solid cut strips, ready for drying. Result: Eliminates many manual operations . . . makes floor space available.

HOW THE WATER-BED CONVEYOR OPERATES — The loaded, one-piece steel band "floats" along on an open trough of circulating water. The water pressure assures 100% coolant contact with the belt. The trough is so designed that no water can get on top of the belt. After cooling, the delicate film is deposited on a take-off conveyor at whatever point gravity separates it from the underside of the main steel belt.

HOW TO "PRE-TEST" THE WATER-BED CONVEYOR WITH YOUR OWN PRODUCT — Sandvik has available, portable experimental units on which you can make small scale trials of your own product, in your own plant. You will see for yourself the cooling capacity of this conveyor and how it can open new processing possibilities.

Experimental water-bed units are available on request. Sandvik's engineering department will be glad to provide technical advice and help. Write, wire or phone for complete details.

SANDVIK STEEL, INC.

Conveyor Division

111 Eighth Ave., New York 11, N. Y.
Watkins 9-7180

Manufacturers of Steel-Belt
Conveyors For Over 30 Years



55-72

Handles HOT or Abrasive Chemicals SAFELY!

METAL CONSTRUCTION

Sieve frames and box are made of magnesium — strong but light in weight. Screens can be had with silk cloth or wire — as required.



COMPACT DESIGN

Complete with motor and Texrope Drive, this compact Allis-Chalmers sifter requires very little floor space and head room.

EASY TO CLEAN

It can be cleaned with brush, air hose or steam—and can be washed with hot or cold water. There's no danger of warpage.

VERSATILE

Can be used for efficient sifting and grading of a variety of chemicals — including those which are hot and abrasive.

ALL-METAL LOW-HEAD SIFTER

DESIGNED AND BUILT with magnesium sieves and metal housing, the all-metal *Low-Head* sifter has definite advantages for chemical milling applications.

High-temperature materials can be handled without danger of warping or cracking the sieves — which could occur with parts made of wood. Metal construction also makes possible the sifting and grading of *abrasive* chemicals.

Complete with *Texrope* Drive and 1 hp motor, the all-metal *Low-Head* sifter is easy to install. Little floor space or head room is required. Capacity is high — depending upon number of sieves used in the unit. The standard box has three to seven sieves. A larger unit is available with eight to eleven sieves.

Cleaning is no problem because the entire machine can be safely washed with hot or cold water — or cleaned with air hose, with steam or by brushing.

Get full details from your nearest A-C sales office or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

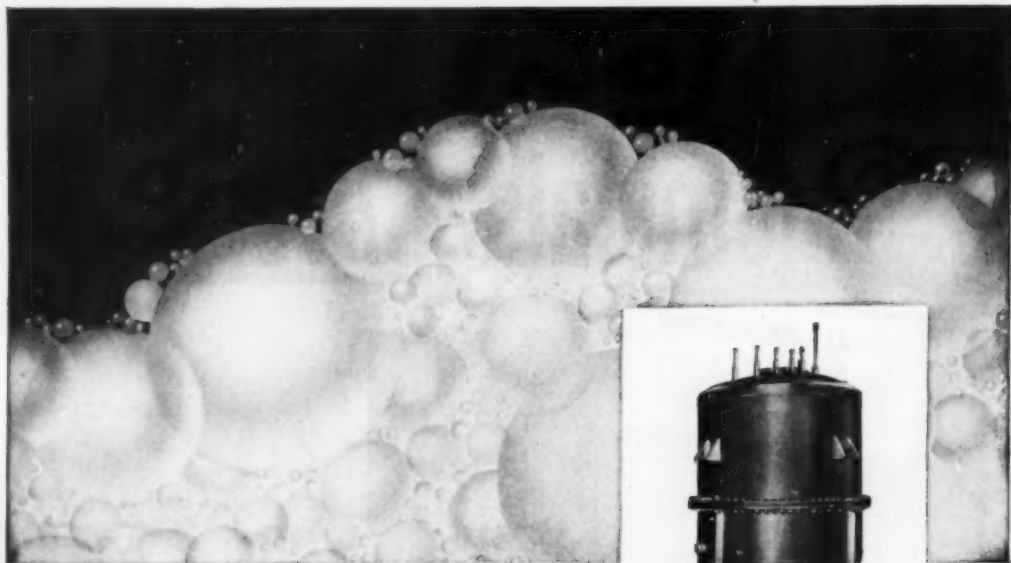
A-3229

Low-Head and Texrope are Allis-Chalmers trademarks.



ALLIS-CHALMERS

CHEMICAL MILLING AND PROCESSING EQUIPMENT



Production Pointer

... from a Glycerine Still

Extra productivity . . . reduced costs . . . or trouble-free performance . . . which interests you most? You'll find an idea on each in this case history . . . for it's typical of the results that creative equipment builders can offer by applying clad steels.

Delivering production improvement in spite of materials and manpower shortages is the prime contribution of progressive equipment builders. An important factor in this is the application of the Lukenomics principle. For Lukenomics combines their experience and that of designers and engineers with Lukens' specialized knowledge of materials and their application. This kind of cooperative ingenuity pays off for the equipment purchaser. We'll gladly put you in touch with equipment builders who apply the Lukenomics principle. Just write, stating your equipment problem, to Manager, Marketing Service, Lukens Steel Company, 400 Lukens Building, Coatesville, Pennsylvania.

With the defense program's having first call, you'll understand why Lukens specialty steel products for civilian use are not so plentiful as in normal times.



Modernization of a leading soap maker's glycerine distillation system called for increased production, new fuel economy and space conservation. New equipment included a still pot of Lukens Nickel-Clad Steel with solid nickel steam coils. Process involved crude with high salt content at 250°F, entering vessel under vacuum, and brought to 330°F. Design economically eliminates multiple distillation, providing faster heating, corrosion resistance, structural strength to withstand vacuum. Result: Production efficiency increased, fuel and maintenance reduced, equipment life lengthened. Using nickel-clad steel instead of solid nickel, the equipment builder effected a 71% saving of critical nickel and reduced equipment cost. This is Lukenomics at work.



LUKENS STEEL COMPANY

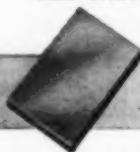
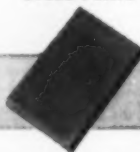
OVER 140 YEARS' EXPERIENCE AS THE WORLD'S LEADING PRODUCER OF SPECIALTY STEEL PRODUCTS

STEEL PLATE

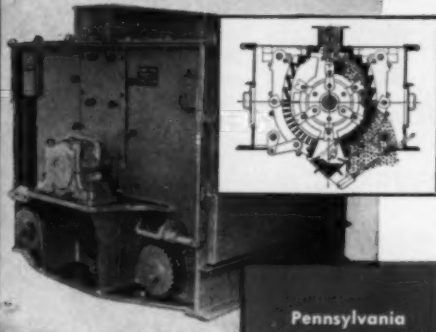
CLAD STEELS

HEADS

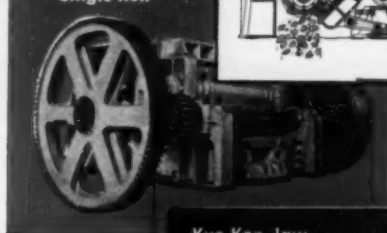
STEEL PLATE SHAPES



Pennsylvania Reversible Hammermill



Pennsylvania Single Roll



why Pennsylvania makes many types of crushers

Crushing problems are seldom, if ever, identical because of variables such as product, feed size, capacity, moisture content, and physical and chemical structures of material—and *no one type of crusher can meet all of them.* That's why Pennsylvania has a large and varied line, a portion of which is illustrated here. In this line there is a type of crusher adapted to deal with each individual job no matter what it may be, and since our engineers are not limited to only one or two types when making a recommendation, you can be assured there is no bias or prejudice in favor of a specific crusher. This is one of the very good reasons to at least get Pennsylvania's counsel on every crushing job. Even if you aren't ready for a new crusher we'll be glad to check your operation and report on its efficiency. This could well be the first step towards reducing your operation costs.

REVERSIBLE HAMMERMILL

The Pennsylvania Reversible Hammermill with 2 Zone Crushing and Adjustable Cage offers great economy in operation and maintenance while producing a coarse or medium fine product without using a closed circuit system. The Reversible feature virtually makes this machine two crushers in one. Press a button—today clockwise—tomorrow, counter clockwise. Send for Bulletin 1034.

SINGLE ROLL

Requiring surprisingly little headroom, Pennsylvania Single Roll Crushers are powerful machines that have big hourly capacities at low cost per ton and can handle wet, sticky and frozen materials without choking or jamming. Massive Breaker Plate is easily adjustable to or from the Crushing Roll. This permits product size change at any time and also compensates for gradual wear of working parts. Send for Bulletin 2011.

KUE-KEN JAW CRUSHER

The improved design of the Kue-Ken Jaw Crusher, using the "crushing without rubbing" principle, is the one great advancement in jaw crushers in many years. It replaces the old, poorly lubricated, slow speed, unavoidably heavy machine that gave operators a low opinion of the jaw. The Kue-Ken gives you—2 to 5 times greater capacity, 5 to 10 times longer jaw plate life, much lower power requirement, a completely enclosed oil bath lubrication with clean, constantly filtered oil, and other features that put the Kue-Ken way out in front. Send for Bulletin 5011.

DIXIE NON-CLOG HAMMERMILL

Wherever sticky, wet materials may be encountered, there the Dixie Non-Clog Hammermill is without parallel in efficiency. The moving, extended Breaker Plate keeps the most difficult mucky feeds from choking the mill, holding production at peak capacity. The crushing is done on the numerous moving Breaker Plates, therefore wear is distributed over a large area, prolonging plate life, thus reducing maintenance cost.

REVERSIBLE IMPACTOR

The Pennsylvania Reversible Impactor reduces by direct impact at controlled slow speeds, producing cubed particles uniform in size. Reduction ratio is quite large, a reduction of minus 10" feed to 1/4" in one operation is not unusual (closed circuited with external screening or separating equipment). This is an ideal crusher for high silica and abrasive rocks, clinkers, minerals and chemicals. The Reversible Rotation feature doubles the life of principal working parts. Send for Bulletin 6016.

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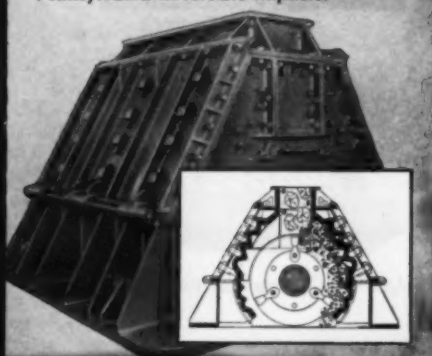
Single Roll Crushers • Reversible Impactors • Reversible Hammermills • Ring-Type Granulators • Rodmills • Bradford Hammermills • Kue-Ken Jaws • Kue-Ken Gyrocons • Dixie Non-Clog Hammermills • Dixie Feed Mills and Process Grinders

PENNSYLVANIA
CRUSHER COMPANY

PENNSYLVANIA CRUSHERS

What
type of
crusher do
YOU
use?

Pennsylvania Reversible Impactor



DREW LAURIC ACIDS

AAB. 85%—90% LAURIC ACID FRACTIONATED—DISTILLED

AAB is more than a distilled fatty acid, it is fractionated to improve color, odor and composition. It is of high purity, extremely low iodine value and is stable at high temperatures. Very popular among alkyd resin manufacturers for making stable, white baked finishes. Also used for top quality floor waxes, plasticizers and emulsions. Pure metallic soaps of AAB lauric acid are widely used in cosmetic and drug industries.

ABL. 70% LAURIC ACID FRACTIONATED—DISTILLED

ABL is a high lauric content coconut fatty acid. It is stabilized to safeguard color on prolonged heating. Used in high grade cosmetic preparations, plasticizers, stabilizers, metallic soaps, shampoos, shaving creams, wetting agents, household detergents, 40% liquid soaps, paste and other types of soap. Many condensation products used in various industries also use ABL lauric acid.

TYPICAL AVERAGE COMPOSITION AND DATA

plastic
metallic soaps of 7
are widely used in cosmetic and
drug industries.

TYPICAL AVERAGE COMPOSITION AND DATA

PRODUCT	CAPRYLIC (Ca)	CAPRIC (Ca)	LAURIC (Ca)	MYRISTIC (C ₁₄)	PALMITIC (Ca)	STEARIC (Ca)	OLEIC (Ca)
AAB	2.0%	4.0%	90.0%	2.0%	0.0	0.0	2.0%
ABL	1.5%	3.5%	70.0%	13.0%	8.0%	1.0%	3.0%

PRODUCT	FFA	TITRE °C	IODINE VALUE	ACID VALUE	SAP. VALUE	COLOR 5%* Lambond
AAB	139-144	37.0 Min.	3.0 Max.	277-286.4	277-286.4	15.0/2.0
ABL	138-141	30.0 Min.	5.0 Max.	274.4-280.4	274.4-280.4	20.0/3.0

Distilled and Fractionated Fatty Acids:

OLEIC COTTONSEED STEARIC VRO CAPRYLIC

Distilled and Fractionated Fatty Acids:

SOYA	SAFFLOWER	LINSEED	OLEIC	COTTONSEED	STEARIC	VRO
COCONUT	LAURIC	CAPRIC			CAPRYLIC	

Write for reference booklet, "Drew Fatty Acids"



TECHNICAL PRODUCTS DIVISION

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April 1951—CHEMICAL ENGINEERING

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I am interested in obtaining greater product uniformity from my present mills.

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Company _____

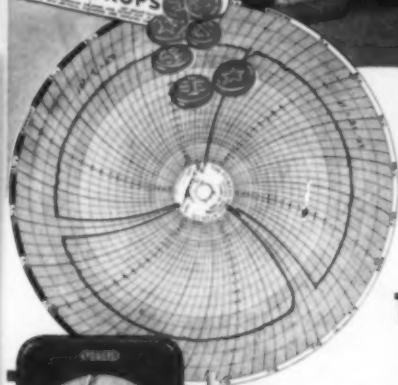
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CANADIAN MFRS: Canadian Vickers, Ltd., Montreal, P.Q.

A "TRAYLOR" LEADS TO GREATER PROFITS



SMITH BROTHERS
COUGH DROPS



Temperature Chart shows above indicates type of control obtained at Smith Brothers with Powers Recording Temperature Regulators.

At right: Powers FLOW-RITE Diaphragm Valve.



Cooking of the "World's Best-Tasting Cough Medication"
Is Automatically Regulated by

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They Save Labor — Help Insure Uniform QUALITY

For 104 years Smith Brothers cough drops have been famous for good flavor by seekers of cough relief. When Smith Brothers sought relief from the errors and losses of manual control of cooking operations they installed Powers Recording Regulators in their plants at Michigan City, Ind. and Poughkeepsie, N. Y.

When you want better temperature or humidity control for

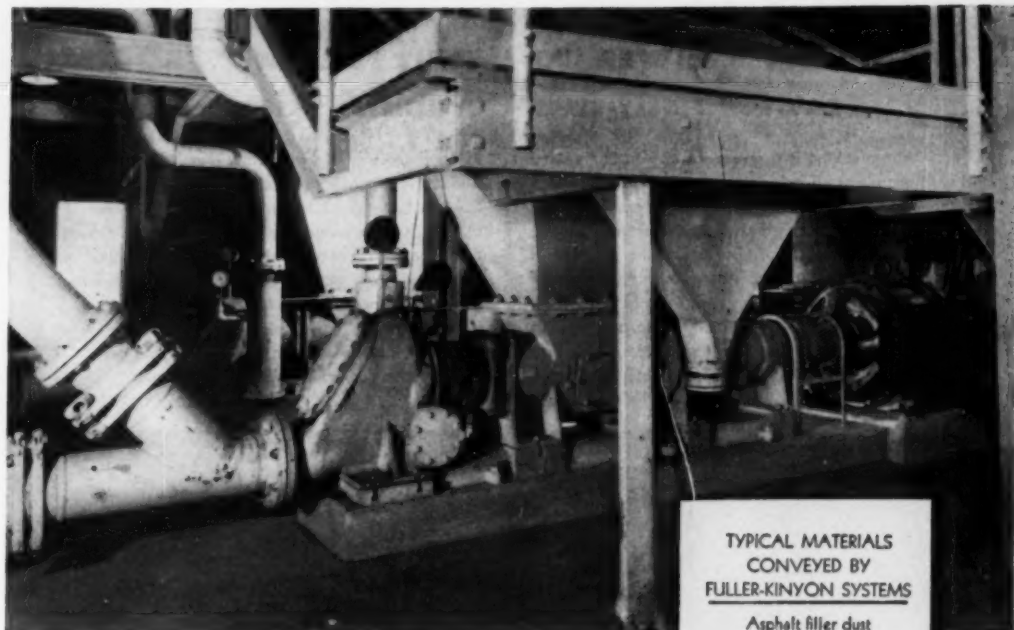
AIR CONDITIONED process or packaging rooms
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... contact your nearest Powers Office. There's no obligation. With 60 years of experience and a wide variety of self operating and pneumatic controls we may be able to help you select the best equipment for your requirements.

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If it can be *Aerated*
many materials can be conveyed
with a **FULLER-KINYON SYSTEM**

Fuller pioneered the conveying of dry pulverized materials by aeration . . . flowing them from place to place . . . fast and economically. Today, if it can be aerated, many materials used industrially can be conveyed with a Fuller-Kinyon System.

This system eliminates the danger of fire and explosion. It's efficient, clean, economical to operate. Power consumption low—conveying pipes can be carried overhead, hung on simple hangers, or buried underground—conveys horizontally or vertically, and around corners.

Ask a Fuller engineer to survey your present handling methods. After careful study and analysis, he'll make his recommendations. They're worth going over carefully. Chances are good they'll show you how you can increase operating efficiency while you reduce operating costs.

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CONVEYED BY
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- Barytes
- Bauxite
- Catalysts
- Cement (Portland)
- Cement raw materials
- Chalk
- Clays (dried)
- Coal (pulverized)
- Coke dust
- Dolomite (pulverized)
- Feldspar
- Flue dust
- Fly ash
- Fuller's earth
- Gypsum (calcined)
- Gypsum (raw)
- Lime
- Limestone (pulverized)
- Magnesite
- Manganese dioxide
- Ores (pulverized)
- Phosphate rock (pulverized)
- Rock dust
- Soda ash
- Starch

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**DRY MATERIAL CONVEYING SYSTEMS AND COOLERS
COMPRESSORS AND VACUUM PUMPS
FEEDERS AND ASSOCIATED EQUIPMENT**

P-124

THIS IS THE ANSWER TO

DAVISON FINELY-SIZED

Where caking is a problem, Davison finely-sized synthetic silicas offer double-action control. When such silicas are mixed with a granular or powdered product they not only add a thin but effective coating to the particles, but also adsorb the moisture or mother liquor that otherwise would accelerate caking. These Davison silicas are as small as .5 micron diameter with uniformity of structure insured by rigid production controls. They offer surface areas up to 1000 square meters per gram.

YOUR "CAKING" PROBLEMS

SYNTHETIC SILICAS

Being chemically and physically inert, they are adaptable in many varied applications.

Davison finely-sized, amorphous synthetic silicas of high purity are currently being used as anti-caking agents in dyes, chemicals, insecticides, foods and pharmaceuticals. Davison's diversified experience and years of research are available to aid you in your caking problems. For additional information, specifications and samples of Davison silica gel write, mentioning your proposed application.



Progress Through Chemistry

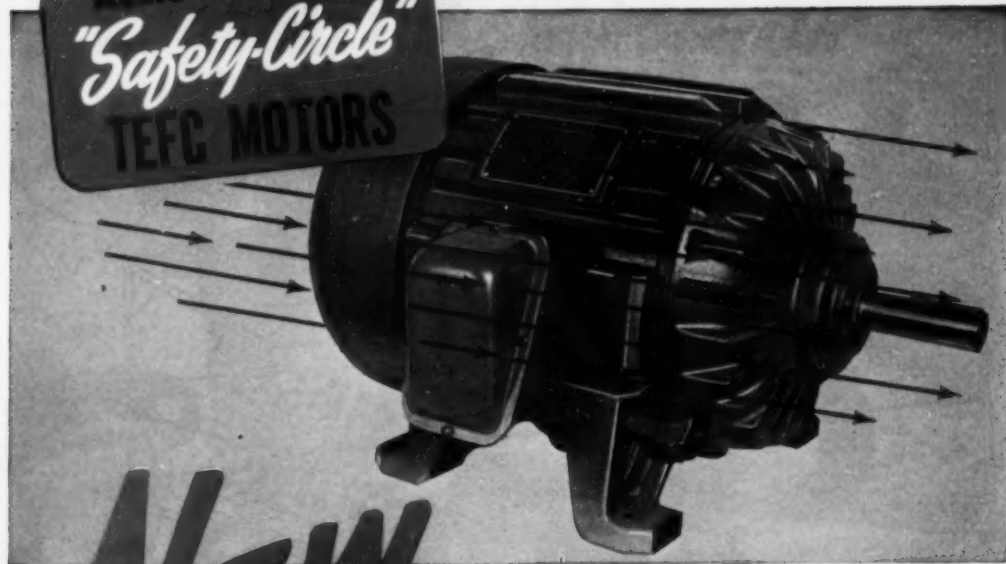
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ALLIS-CHALMERS
"Safety-Circle"
TEFC MOTORS



NEW Easy to Clean Resists Corrosion

CORROSIVE ATMOSPHERES CAN'T HURT this Allis-Chalmers totally enclosed, fan-cooled motor because major parts are enclosed in a rigid corrosion resistant cast iron frame! No extra treatment is needed and cast iron's corrosion resistance won't chip off.

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No corners, pockets or hidden air passages to collect dirt. Cleaning is the simplest of maintenance operations. Just blow off the dirt with an air hose. Fan and housing design keep cooling air-flow tight against the yoke so dirt does not accumulate and cleaning is seldom required.

Factory Lubricated Bearings

Bearings are lubricated at the factory and operate without attention or cost for years. Extra rigidity of the cast iron frame holds bearings in true alignment under all operating conditions. This gives long bearing life and low operating costs.

Get All The Facts

The new *Safety Circle* totally-enclosed fan-cooled motor is built in all NEMA standard frame sizes from 224 to 505. Call your nearest Allis-Chalmers Authorized Dealer or Sales Office for complete information or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B6144.

A-3228

Safety Circle, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

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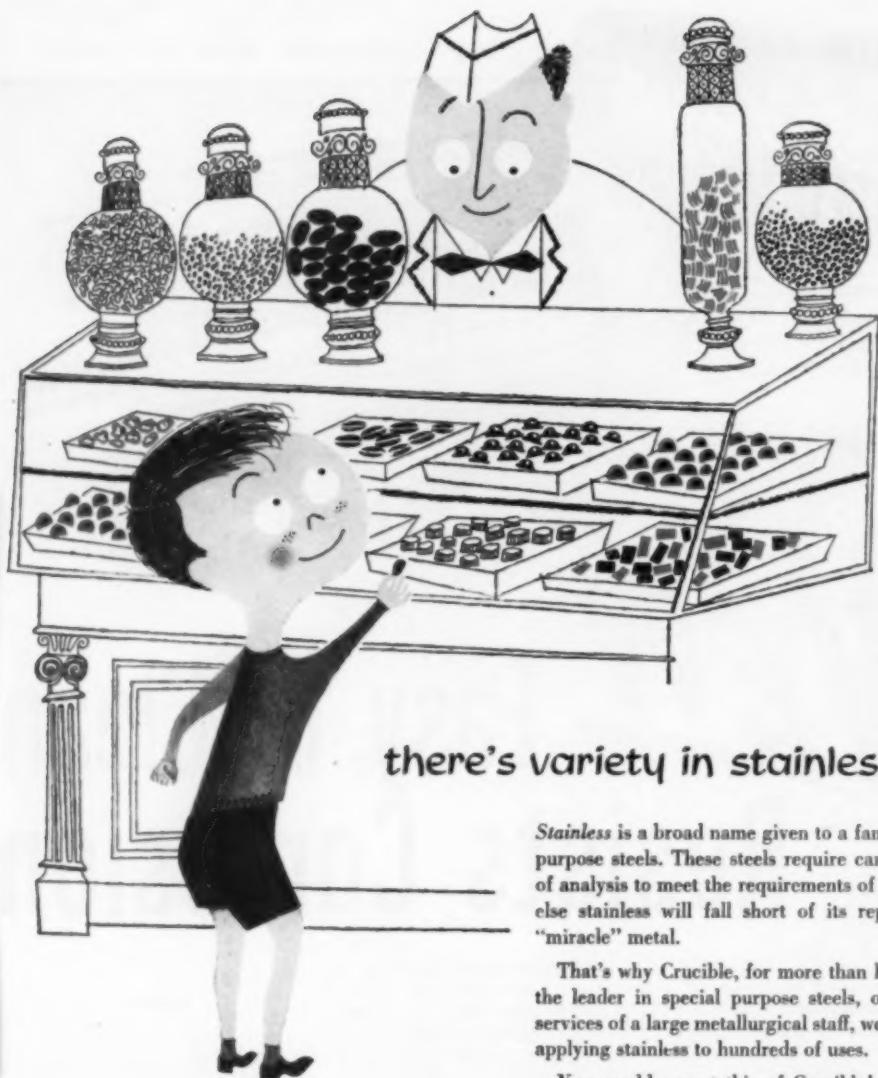


CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



PUMPS — Integral motor and coupled types from 1/2 in. to 72 in. discharge and up.



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Stainless is a broad name given to a family of special purpose steels. These steels require careful selection of analysis to meet the requirements of the user — or else stainless will fall short of its reputation as a "miracle" metal.

That's why Crucible, for more than half a century the leader in special purpose steels, offers you the services of a large metallurgical staff, well-schooled in applying stainless to hundreds of uses.

You would expect this of Crucible! For Crucible was one of the first to build — from the ground up — a completely integrated mill to roll stainless exclusively. If yours is a stainless steel application, call on our unequalled background of experience. CRUCIBLE STEEL COMPANY OF AMERICA, Oliver Building, Pittsburgh, Pennsylvania.

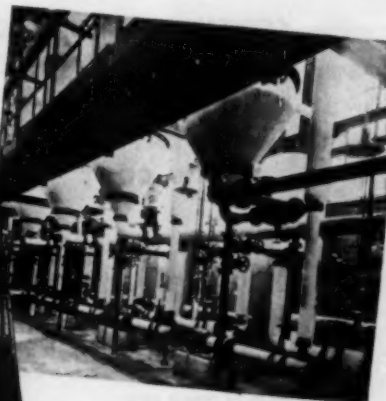
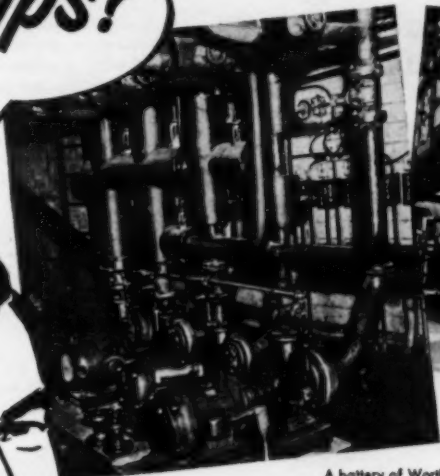
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Looking for evaporator pumps?



Worthite pump handling distillery slop.

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By standardizing on a complete range of sizes in one superior stainless steel, Worthington can concentrate its volume and inventories. This means you can get the centrifugal pump and parts you need for handling corrosive liquids and other chemicals. Thousands of these Worthington standard pumps are now in evaporator service, pumping such widely varying liquids as black liquor, ammonium sulfate and frozen orange concentrate. Their advanced design and exceptional resistance to abrasion and corrosion assure best results at lowest operating cost.

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Worthington has evolved a scientific

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1

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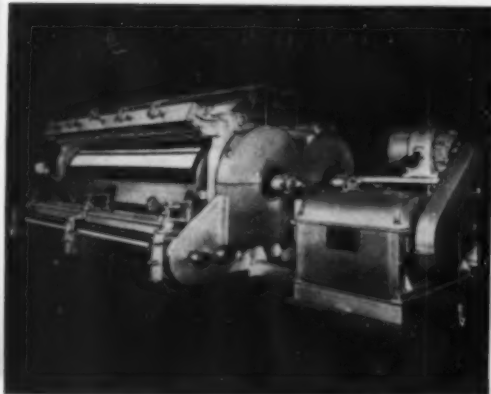
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Quick, low-temperature drying ... protection from contamination ... freedom from dust or toxic hazards, are advantages only BUFLOVAK can offer.

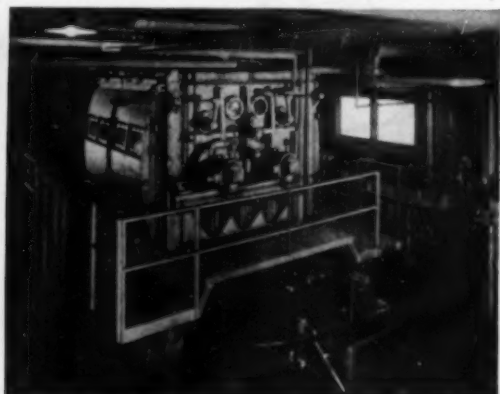
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You get the results you want because only BUFLOVAK builds all the different types and knows from experience what to recommend.

Catalog No. 348 has complete information. May we send you a copy?



Soap is dried on this special BUFLOVAK Atmospheric Double Drum Dryer equipped with cooling rolls.



BUFLOVAK Vacuum Double Drum Dryer, sanitary type, Stainless Steel, with chrome plated drums. Used for drying a food product.

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Distillation Equipment



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To assist you in the solution of processing problems, BUFLOVAK offers the facilities of its Research and Testing Laboratory—where small scale experimental units show you, before you buy, the commercial possibilities, data on production cost, and characteristics of the finished product.

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... as compared to
the blower that keeps air fresh

Your men can't produce at top efficiency when stagnant, hot or fume-filled air robs them of their energy.

Wherever bad air slows down production . . . in shipholds, tanks, drums, boilers or other places where men need fresh, cool air . . . a Coppus Blower becomes both a safety device and a production tool.

Portable and easily adaptable for special purposes, Coppus "Blue Ribbon" Blowers

and Exhausters fit all your "fresh air" requirements. The Coppus "Blue Ribbon" means premium performance at ordinary cost. Check and mail the coupon for specific information. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, BEST'S SAFETY DIRECTORY, MINING CATALOGS.

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| <input type="checkbox"/> in tanks, tank cars, drums, etc. | <input type="checkbox"/> on boiler repair jobs. |
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| <input type="checkbox"/> on steam-heated rubber processes. | <input type="checkbox"/> general man cooling. |
| | <input type="checkbox"/> around cracking stills. |

(Write here any special ventilating problem you may have.)

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| <input type="checkbox"/> exhausting welding fumes. |
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|---|
| <input type="checkbox"/> stirring up stagnant air wherever men are working or material is drying. |
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| <input type="checkbox"/> drying of walls, sheets; etc., after treated with coating material. |
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Six frame sizes —
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PLASTIC

STOPS CORROSION

Tygon Plastic makes an ideal gasketing material for corrosive service. It is resistant to not only all the chemicals rubber will handle satisfactorily, but is particularly effective with highly oxidizing solutions where rubber is noticeably weak.

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It's worth checking into — one or more of the many specialized formulations of the versatile series of Tygon Plastics may provide the answer to some of your toughest corrosive problems.

The U. S. Stoneware Co., Tallmadge Square, Akron 9, Ohio



SHEET TYGON heavy duty tank linings; die cut gaskets.



EXTRUDED TYGON — Tubing, channel, special shapes, solid cord.



LIQUID TYGON quickly applied coating, as protection against corrosive fumes.

MANUFACTURERS AND FABRICATORS OF CORROSION RESISTANT MATERIALS AND EQUIPMENT SINCE 1865

THE Chemementator

Reg. U. S. Pat. Off.

Prepared under the editorial direction of Joseph A. O'Connor, News Editor

Phosphate ores: new source of uranium

It is "economically feasible," reveals Jesse Johnson, manager of AEC's raw materials office, to extract uranium from phosphates during the manufacture of fertilizer.

To get the uranium, certain extra processing facilities have to be added to plants already making triple superphosphate. The uranium is extracted between the phosphoric acid stage and the production of the final product. Details of the process are classified, the AEC states.

Phosphate ores in Florida will be developed as a uranium source by International Minerals & Chemical Corp. "It is my hope," says President Louis Ware of International, "that we will be able to produce it in appreciable quantities and on a profitable basis. We are engaged in some work for the atomic commission."

Zirconium producers, front and center

To encourage new producers of zirconium, the Atomic Energy Commission is going to disclose technical information on the manufacture of high-purity zirconium metal. It's now being made in government-owned or controlled plants, using processes developed by the Bureau of Mines or AEC contractors.

Private producers in a position to supply zirconium metal or the intermediates in its manufacture will get the know-how from AEC's Division of Engineering.

Major steps in getting the pure metal from commercial zirconium tetrachloride are: (1) separation of hafnium from the crude zirconium tetrachloride; (2) chemical purification of the separated zirconium; (3) calcination and rechlorination of the purified zirconium; (4) reduction of purified tetrachloride using the basic Kroll process; and (5) refining of the reduced metal, using the basic de Boer process.

Blanket NPA order on chemicals

As a stopgap measure, NPA was expected to issue a general chemical order similar to WPB's M-300 order in World War II.

The chemical industry advisory committee has agreed unanimously that NPA should adopt without delay a regulation to assure the orderly flow of strategic chemicals to defense and essential civilian uses.

Committee members pointed out that while the chemical industry is expanding to meet the demand for its products, direction is needed for the temporary distribution of chemicals in tight supply.

NPA officials say this basic order would not in itself place any chemical under allocation, but would provide the means by which it could be done. Before a chemical would be placed under such control the industry would be consulted and a thorough study made.

Details of the expected order include these: (1) small users of chemicals may be exempt from the order, thus aiding small business; (2) three categories would be set up for allocation, and a particular chemical could be made subject to any one of them, depending on its relative importance and supply; and (3) any chemical allocated would be decontrolled when control is no longer needed.

Although NPA officials will not say so, it's believed that the blanket order on chemicals will be used only until NPA puts into operation the controlled materials plan (CMP). CMP is to be effective on July 1 according to best reports.

Not enough sulphur for fertilizers

ALLOCATION—Refusal of Defense Mobilizer Charles E. Wilson to hold up allocation orders on sulphur and sulphuric acid until full hearings could be held caused the subcommittee on fertilizer and farm machinery of the House Agriculture Committee to cut short its planned excursion into the shortages of sulphur and sulphuric acid for fertilizer.

RECOMMENDATIONS—After four days of rushed hearings the subcommittee, headed by Rep. Thomas G. Abernethy, urged that: (1) agriculture be recognized as a defense industry in allocating critical materials; (2) Agriculture Department officials be appointed to policy-making agencies; (3) sulphur exports be reviewed to see how much foreigners can do without; (4) present users of sulphur and sulphuric acid be surveyed to find if they are wasting any that could be re-used; (5) long-range sources of sulphur and sulphuric be investigated by the government, and that sulphur recovery be required, where appropriate, as a condition for getting fast amortization or other government help; and (6) research be stepped up on methods of producing phosphate fertilizer using less sulphuric acid.

FARMERS' FLIGHT—Frank K. Wooley of USDA's Production & Marketing Administration said farmers will need 1,335,000 long tons of sulphur for superphosphates, 420,000 long tons for ammonium sulphate and 219,000 tons for other uses. He urged

(Continued on page 70)

THE CHEMENTATOR, continued

recovery of sulphur now escaping in fumes from smelters, and controls to channel sulphur into fertilizers.

President Russell Coleman of the National Fertilizer Association agreed with USDA's Wooley, but also called for a re-examination of U.S. sulphur export policy. Perhaps foreigners can do without some of our sulphur. The NFA spokesman said if there's no cutback in sulphuric for fertilizer, well over 1 million tons of the 5 million ton estimated 1951 production of sulphur in the U.S. will be used in fertilizer.

CUTBACKS—Sulphur producers told the subcommittee that they are cutting shipments to U.S. customers, affecting fertilizer production. Langbourne M. Williams, president of Freeport Sulphur, told the congressmen that supply to his U.S. customers has been sliced 15 percent. Dale Miller of Texas Gulf Sulphur said his firm had cut its customers' orders for the first quarter of 1951 by 20 percent.

OTHER SOURCES—L. L. Jaquier of Phillips Chemical urged development of sulphur from any source—including smelter gas, sour gas, pyrites and small sulphur domes. He told the subcommittee his firm is ready to consider building a plant to get sulphur from sour gas in West Texas. Phillips would build the plant if it could be assured that the sulphur would be available for its own fertilizer operations.

RATIONING—Joseph S. Bates, director of NPA's Chemical Division, said NPA is working out a system of rationing. But he couldn't say how high fertilizer for farmers would rate as an essential use of sulphur. He said he was sympathetic to farmers' needs, but that in his job he has to be "sympathetic to the needs of other industries, too."

DEFICIT—Total demand for sulphur, including exports, will exceed supply in 1951 by more than 500,000 tons. And there's little immediate prospect of increasing the supply. Hence the problem is to distribute the sulphur where it will do the most good. All in all, the U.S. is currently over a barrel on brimstone.

Fast write-off on alcohol plant

Defense Production Administration has approved the certificate of necessity filed by Tennessee Eastman for construction of a synthetic ethanol plant at Longview, Tex. Amount certified is \$5,787,000.

Tennessee Eastman's alcohol plant was certified for 50 percent amortization. DPA's explanation for the low percentage is that it is a facility for making products that will presumably be marketable after the current emergency. A facility making military specialty items is granted a higher rate of tax write-off. Average of all during first two months of 1951 is 74 percent.

The action permits a company to amortize a new facility for tax purposes over five years instead of the 20-year period that usually applies under the tax law. But first DPA has to certify a facility as necessary for the national defense.

Tax hike on Texas minerals?

Natural resources may come in for higher taxes in Texas before the present session of the legislature at Austin is over. This move was brought on by the drive to raise funds in order to avoid certain economy measures facing the government.

Rep. R. E. Blount proposes money saving only after the natural resources are required "to pay their just share of the tax load." Representative Blount has introduced three bills that if passed would affect the chemical industry.

The first, H.B. 153, would change taxes on carbon black. It would plug loopholes by taxing carbon black made from raw materials other than gas. The bill would also increase the rate on class B carbon black (selling for 4 c. a lb. or less) from 31/240 to 32/240 of 1 c.

H.B. 154 would increase the tax on sulphur from \$1.272 per long ton to \$2.

H.B. 179 is a tax on natural gas. On sweet and sour gas a maximum of 11.44 percent of market value is proposed. But the tax would never be less than 242/1,500 of 1 c. per 1,000 cu. ft.

Food Machinery hits chemical jackpot

Chemicals have become the biggest money maker for Food Machinery & Chemical Corp. of San Jose, Calif., an increasingly diversified and fast growing firm. Last year the company's chemical division produced slightly over 50 percent of the total volume of business, compared with 19 percent from food processing machinery and 30 percent from agricultural and other machinery.

Food Machinery & Chemical estimates that the volume of sales of chemicals will increase 120 percent at the end of the next five years, bringing chemicals to a point where they will comprise 67 percent of total company sales by that time. Food Machinery has an expansion program of more than \$25 million laid out.

CSC first: automatic unit for antibiotics

First fully automatic antibiotic production unit in the world is nearing completion at the Terre Haute, Ind., plant of Commercial Solvents. It's expected to be in operation by May.

Instead of the three originally planned, a total of six fermenters are being installed. They're needed to meet expanding defense requirements. Penicillin and bacitracin, as well as other antibiotics, will be produced.

(Continued on page 74)

Columbia


A DEPENDABLE NAME IN

Chemicals

For over half a century, Columbia has been a leader in the production of alkalis and related chemicals. And, within the last five years, Columbia has expanded its operations to include a variety of organic chemicals.

Columbia's long-established reputation comes from many things. It comes from Columbia's record as a volume producer of quality chemicals . . . from the expert technical service Columbia renders to its customers . . . and from Columbia's many improvements and innovations in chemical manufacturing, shipping and handling.

The customers of Columbia know they can always count on top quality chemicals and technical assistance that may lead to savings in shipping and storage space, time, labor and money.

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CAUSTIC SODA
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SODIUM BICARBONATE
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MONO-CHLOROBENZENE
ORTHO-DICHLOROBENZENE
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PITTSBURGH PLATE GLASS COMPANY

SEVEN I-T-E MECHANICAL RECTIFIERS

Two years ago, Buffalo Electro-Chemical Company, Inc., Buffalo, N. Y., installed two I-T-E Mechanical Rectifiers, the first mechanical rectification units ever built in this country.

This pioneering spirit of Buffalo Electro-Chemical's progressive management justified itself to the extent that at present I-T-E has orders for five more Mechanical Rectifiers—to augment Buffalo's current modernization program.

I-T-E's Mechanical Rectifier has benefited Buffalo Electro-Chemical—and can handle your low voltage power conversion requirements more effectively.

1 HIGHER EFFICIENCY—actually 96% or more in the 100 to 400 volt range, because silver to silver contact minimizes voltage drop in rectifying element.

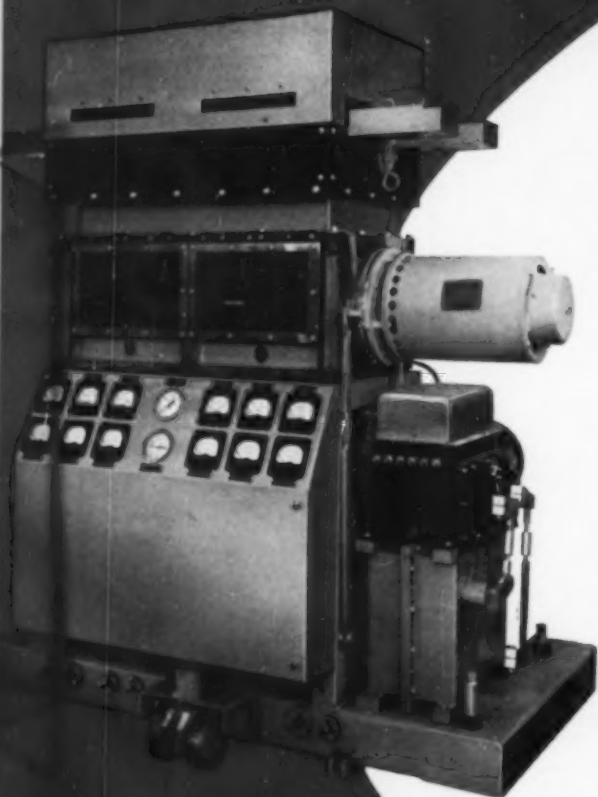
2 SPACE SAVINGS—extremely compact grouping of all operating and protective apparatus.

3 EASY, LOW-COST INSTALLATION—unit assembly at factory allows "packaged" delivery, easy installation. No special structural foundations are required; no crane service is needed in rectifier room.

4 SIMPLE, LOW-COST MAINTENANCE—maintenance is almost entirely mechanical, requiring no trained personnel, complicated tools or instruments for servicing.

5 SIMPLE OPERATION—push-button starting without preliminary warm-up of any kind; immediate connection to load.

6 SAFETY—use of low voltage in your cell room increases safety to operating personnel and equipment.

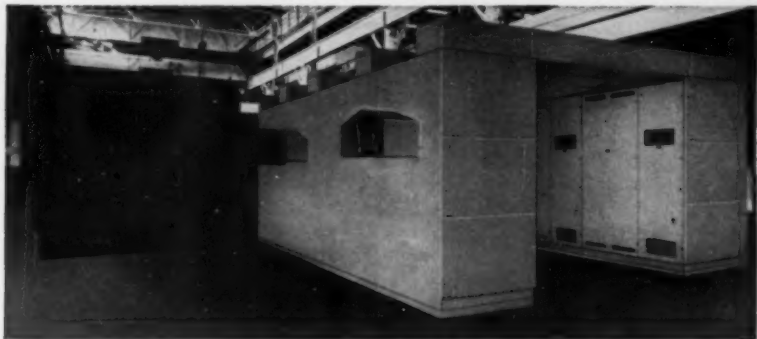


The heart of the I-T-E Mechanical Rectifier—one 10,000 ampere contact mechanism with contact engagement in less than 1/1000 second—can be seen through window. At right is the drive motor, with an automatic regulator bridge. The 12 indicator bulbs show the timing of each contact with the mechanism is opening and carrying load.

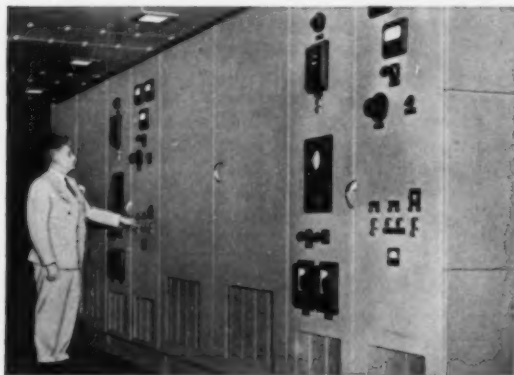
I-T-E Mechanical Rectifiers are available in the following ratings: 4,000—5,000—6,000—7,000—8,000—9,000—and 10,000 amperes, in any voltage from 10 to 400 volts d.c. Primary voltages 2,300 to 48,000 three-phase a.c.

FOR BUFFALO ELECTRO-CHEMICAL

TYPICAL I-T-E MECHANICAL RECTIFIER ARRANGEMENTS



Factory assembly of two 10,000 ampere units with outdoor transformer (only one of two shown), throat connection through wall rectifier enclosure, operating aisle and d-c switchgear compartments.



Close-up of control and instrument panel. The thoroughness of I-T-E engineering is illustrated by the overhead lights, furnished with the installation and assuring proper illumination of the control panel.



View looking through operating aisle. Control cabinet and control panel to left, d-c switchgear to right, throat connecting d-c bus overhead.



MECHANICAL RECTIFIERS

I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 33, Pa.

Power Switching Equipment - Factory and industrial Engineering Co., Bensalem, Pa.

Canadian Mfg. & Sales - General Power Systems, Ltd., Toronto

Export Sales - Philips Export Corp., New York

MECHANICAL RECTIFIERS • CIRCULAR RECTIFIERS • D-C SWITCHGEAR • THROAT CONNECTIONS • CONTROL PANELS • OVERHEAD BUSES • SPECIAL EQUIPMENT

THE CHEMENTATOR, continued

Sales of pharmaceuticals other than penicillin by Commercial Solvents were 78 percent greater in 1950 than the year before. Despite introduction of new antibiotics during 1950, sales of penicillin kept climbing. And bacitracin showed a big increase in sales. Pharmaceuticals accounted for 14 percent of total sales in 1950. Net sales of Commercial Solvents were \$44,991,376 last year, up 35 percent from the \$33,347,682 recorded the previous year.

Callback of reservists threatens crisis

If the armed forces keep up the indiscriminate recall of reservists engaged in scientific and engineering work, they will seriously jeopardize the ability of the chemical industry to produce chemicals badly needed for defense. The Manufacturing Chemists' Association has warned Assistant Defense Secretary Anna M. Rosenberg of this danger.

A spot check by MCA of 29 chemical companies employing a total of 20,216 scientists and engineers (roughly one-quarter of the industry), reveals that 21.6 percent of these technical employees are in the reserves and are subject to recall under present policies. Figures for individual companies range from a low of 7.9 to a high of 47.9 percent.

Far from being adequately staffed at present, the chemical industry has immediate need for 7.4 percent more qualified technical people. And by July it will need 15.2 percent more technical people than it employed in January. They'll be needed to staff new plants and laboratories slated for completion by July.

Within the past six months the chemical industry has committed itself to major expansions in such essential defense products as magnesium, chlorine, caustic soda, ethylene, phosphorus, styrene, soda ash and others, which will not come into production until well after July. These new plants will require additional scientists and engineers for their design and operation.

The MCA urges that the Department of Defense put into effect the recommendations on reservists of NSRB's Scientific Manpower Advisory Committee, which has set up policies for conserving the nation's scientific and technical talent.

California adds chemical workers

In the wake of the Korean war and the defense program, and partly because of the growth of population in the West, the chemical process industries of California are increasing their ranks of salaried workers and wage earners. By January of this year there were 23,300 more employees than in January 1950 in the categories of paper and allied products; rubber products; primary metal industries; and stone, clay and glass products. For the group as a whole, the growth has been about 16 percent in the 12-month period.

Greatest gain in employment, 31 percent, has been in the primary metal industries, which reflects the expansion in steel and aluminum. Next greatest gain, 23 percent, is seen in the paper industry. This is due to the remarkable expansion in pulp and paper manufacture, as well as expansion of plants producing cartons and other fabricated products. The growth in stone, clay and glass employment has been 17 percent, caused largely by heavy activity in building construction during the last year.

Employment in both chemicals and allied products and the rubber industry has increased by 10 percent each. In the petroleum industry there has been an increase of only 2 percent in employment despite the constant rise in production of petroleum materials. This small gain undoubtedly reflects the high degree of mechanization in petroleum refining, where production can be increased without adding workers.

Packaged salt plant

Manistee Iron Works Co. has developed a small packaged salt plant employing radically improved methods of heat recovery. Such a plant can produce as little as $\frac{1}{4}$ to $2\frac{1}{2}$ tons per hr. of refined crystalline sodium chloride. A conventional multi-effect steam plant rarely produces less than $2\frac{1}{2}$ tons of salt an hour.

Compact, easily erected, easily moved, the new packaged salt plant can be set up in remote areas. A plant making 1 ton of salt an hour goes into 2,000 sq. ft., a reduction of 75 percent or more from the area required for a conventional plant. It takes only two men per shift to operate the salt plant, exclusive of the packaging operations. And fixed charges are low. It's estimated that in the U. S. the capital investment on a 1-ton plant would range from \$150,000 to \$175,000.

But the big market for Manistee's packaged salt plants promises to be in foreign countries. Two are nearing completion in South America. At Caracas in Venezuela a 1-ton plant will be finished in June for Antonio Zoghbi, the salt king of Venezuela. Another plant, due for completion in August, is being built in Rio de Janeiro for Salmac, the big Brazilian salt producing outfit. In most installations, crude salt is redissolved to make a brine from which dry salt is turned out, ready for packaging.

Employment and earnings rise in chemicals

Here's how hours, earnings and employment rose, according to BLS, during 1950 and since Korea in chemicals and allied products. In January 1950, the 658,000 workers were earning \$1.45 an hr., working 41.3 hr. a week and making \$60.05. By June 1950 employment had reached 670,000, workers were getting \$1.50 an hr. for their 41.4 hr and earning \$62.39 a week. Full impact of Korea was felt slowly. But by

(Continued on page 76)



For worms and gears—in standard sets or to special requirements—or as worm-gear speed reducers, including the economical fan-cooled Speedaire unit—you can always depend on Cleveland.

High quality worms and gears to meet your needs

● You pay no more for Cleveland worms and gears—and yet, built into them are extra years of service and satisfaction. Uniform, high quality has been an outstanding characteristic of Clevelands through 38 years—a generation devoted to the manufacture of fine worms and gears exclusively. Specifically, there are four ingredients of Cleveland quality:

1. Correctness of design—design proved best by years of performance.
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So whatever your need, consult Cleveland. Sales representatives in all major industrial centers are at your service, to help you select correct types and sizes and discuss any phase of your power transmission problems.

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CLEVELAND
Worm Gear
Drives

THE CHEMENTATOR, continued

January 1951 employment had climbed to 729,000. And chemical workers were putting in 41.8 hr. at \$1.59 an hr. for a weekly wage of \$66.59.

Kaiser's unfolding aluminum empire

Kaiser Aluminum & Chemical Corp. will shell out \$79 million to expand its output of aluminum pig to 540 million pounds annually. Thus it will be pouring out a total of 80 percent more aluminum than it did before the outbreak of war in Korea. First production will come late this year and full operation by mid-1952.

Construction will be rushed on an aluminum reduction plant near New Orleans, La., that will turn out 200 million pounds a year of aluminum. It will have four potlines. Kaiser will build its own power plant, which will use 70 million cubic feet a day of natural gas, essential in large volume and at low cost to produce primary aluminum.

Kaiser will open up its bauxite deposits in Jamaica to supply the new Gulf Coast reduction plant and also its two plants in the state of Washington.

At Baton Rouge, La., Kaiser will enlarge its bauxite plant to handle the Jamaican ore and to increase from 300,000 tons a year to 540,000 tons the production of alumina.

Du Pont: DMT into Dacron

Du Pont's Repauno plant at Gibbstown, N. J., will be expanded for increased production of nitric acid and the manufacture of dimethyl terephthalate. DMT is made by oxidizing *p*-xylene directly to the ester in the presence of nitric acid and methanol.

The dimethyl terephthalate will be condensed with ethylene glycol to produce Du Pont's new synthetic fiber Dacron, the condensation polymer formerly known as Fiber V.

DMT from the Repauno plant will be shipped to Kinston, N. C., where a plant will be built to make the new fiber. To cost more than \$24 million, the Kinston plant will be completed near the end of 1952, about the same time as the Gibbstown plant. Initially, Du Pont will produce an estimated 10 million pounds of the synthetic fiber.

New salt source for Ohio chemical industry

International Salt has leased a tract near Strongsville, Ohio, where geological surveys indicate large underlying salt deposits at about 2,200 ft. International has a drilling rig on the ground, is already diamond-drilling to test the deposits.

What's planned is a regular salt mining operation there, using a vertical 15-ft. diameter shaft to reach the salt and through which the salt would be brought to the surface. The underground mining operation would be similar to that of International at Detroit.

Production at Strongsville, provided the quantity and quality of the salt is as anticipated, would be about 750,000 tons per year.

International makes no secret of the fact that it has its eye on the chemical industry in the Ashtabula area as a potential market for much of the salt from this new mine. It is already shipping big quantities from Detroit to the Ashtabula plant of National Distillers.

Koppers stakes bigger claim in styrene

EXPANSION—A new plant near Port Arthur, Tex., and additions to its Kobuta, Pa., plant are included in the multi-million dollar expansion that Koppers is launching. Koppers has contracted to purchase 1,000 acres about two miles west of Port Arthur.

ETHYL BENZENE—Koppers will construct a plant that will take ethylene from the unit which Gulf Oil will build at its Port Arthur refinery and combine it with benzene to make ethyl benzene. Ethyl benzene is used in making styrene, needed for synthetic rubber and polystyrene. Benzene will be transported to the Koppers plant, and finished ethyl benzene will be shipped to Kobuta.

It would be uneconomical to ship ethylene to Kobuta and make ethyl benzene there, since ethylene would have to be shipped refrigerated. Ethyl benzene, however, can be shipped without special equipment.

STYRENE—Capacity for the production of styrene monomer will be increased at Kobuta. Polystyrene production facilities there will also be expanded.

SIGNIFICANCE—Within a year, Koppers' output of styrene monomer will be upped about 33 percent; its production of polystyrene, about 25 percent. Koppers, at present, is the nation's third largest producer of polystyrene.

Spent acid pinch-hits for sulphuric

When the sulphuric acid shortage hit the Intermountain area, the continuous triple superphosphate plant of Gates Bros., Inc., at Wendell, Idaho, had to shut down for over a month. During this emergency, Gates engineers, not to be caught off base again, came up with a process for using spent alkylation acid from oil refineries.

As far as George F. Wilkins, general manager at Wendell, knows, this is the first time refinery waste has been used exclusively for the manufacture of phosphoric acid and subsequently triple superphosphate. It took a bit of doing, but the process is now set up so that it can use the spent acid. A contract has been signed with Sinclair Refining for alkylation acid from its Wyoming refinery, and Gates is also getting spent acid from both Standard and Utah Refineries in Salt Lake City.

The Gates fertilizer plant at Wendell is back in operation. Its present capacity is 25,000 tons of triple super a year.

—End



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Product development programs are no longer "one-company" jobs. The bigger your program is, the more you have to rely on the other fellow—and the output of *his* research—to make your own succeed.

Through its continuing development work on both basic and new industrial chemicals, General Chemical can help you "man the saw" in many ways:

For example, General's research has introduced a number of important new industrial chemicals. Some have proved the basis for customers' development programs or the answer to their development problems. Among these helpful "tools" are:

BORON TRIFLUORIDE AND COMPLEXES, *versatile fluorine catalysts for organic reactions*; SULFUR HEXAFLUORIDE, *remarkable new gaseous dielectric*; GENETRONS*, *aliphatic fluorine compounds*; and SULFAN*, *stabilized sulfuric anhydride for sulfonations*.

For special process requirements, you may find General's ability to produce commercial quantities of "custom-made" chemicals equally valuable to you.

These are but some of the services our product development program offers. A personal discussion of your problems may suggest other ways it can "team up" with yours. Let's review them.

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CHEMICALS, SOAP CHIPS, ETC.

Many dry chemicals are being ground with Williams Heavy Duty Hammermills. Capacity is unusually high and power involved and maintenance extremely low.

OIL CAKE (INCLUDING SOYA), COPRA AND COTTONSEED

Such material, easily ground for use as animal food, whether it is expeller cake or hydraulic press cake.

ANIMAL AND FISH BY-PRODUCTS

Hundreds of installations are daily proving our claims for better and more satisfactory reduction of such materials as—cracklings, tankage, fish scrap, raw and dry bones, etc.

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Many canneries, breweries, and municipalities reduce waste materials for disposal with Williams Heavy Duty Hammermills prior to flushing through the sewers with water.

STEEL, ALUMINUM AND OTHER METAL TURNINGS

Such materials are readily reduced to "hand shovel" size for easier handling. A metal trap catches studs, bolts and other uncrushables.

ROOTS, HERBS, BARK AND CHIPS

Such vegetable substances are successfully shredded prior to commitment to extracting processes. This treatment permits maximum extraction from the material.



STANDARD DESIGNS FOR BIG OR LITTLE JOBS

Standard machines are available for the reduction of practically every material. Capacities range from 50 to 600,000 lbs. per hour.

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Impact and roller mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "packaged" crushing and grinding plants.

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Submit your grinding problems to Williams. A sample of the material and description of the desired result will set our facilities to work on a solution to your problem. Visits during test runs and technical consultations are invited.

WG-20-1

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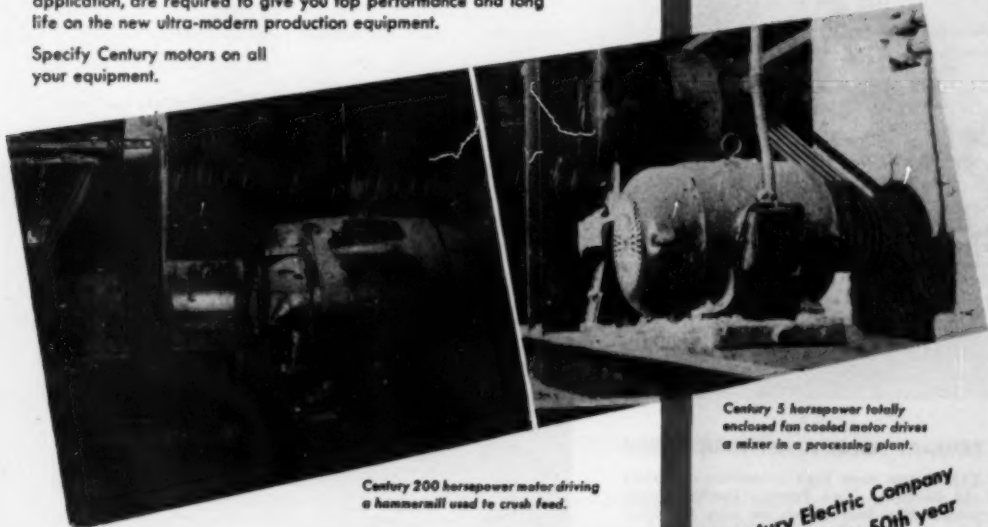
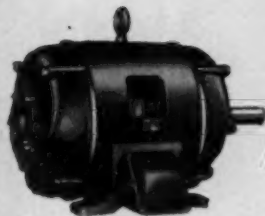
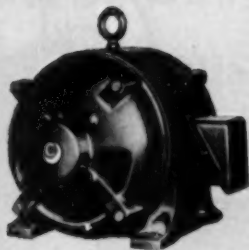
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IN CENTURY'S wide range of types and sizes (up to 400 H.P.) there are available: 4 standard classes of starting torque characteristics—6 methods of speed control—constant and short time ratings—4 basic classes of frame protection against atmospheric hazards—a dozen methods of mounting the motor to the equipment—plus many special specifications to meet the requirements of the BIG NAME equipment manufacturers who use Century motors as a component part of their equipment.

Teamwork with equipment producers gives you skillfully selected motors from Century's wide range of types and sizes... properly applied to match the performance characteristics of the machines they drive.

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1. Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.
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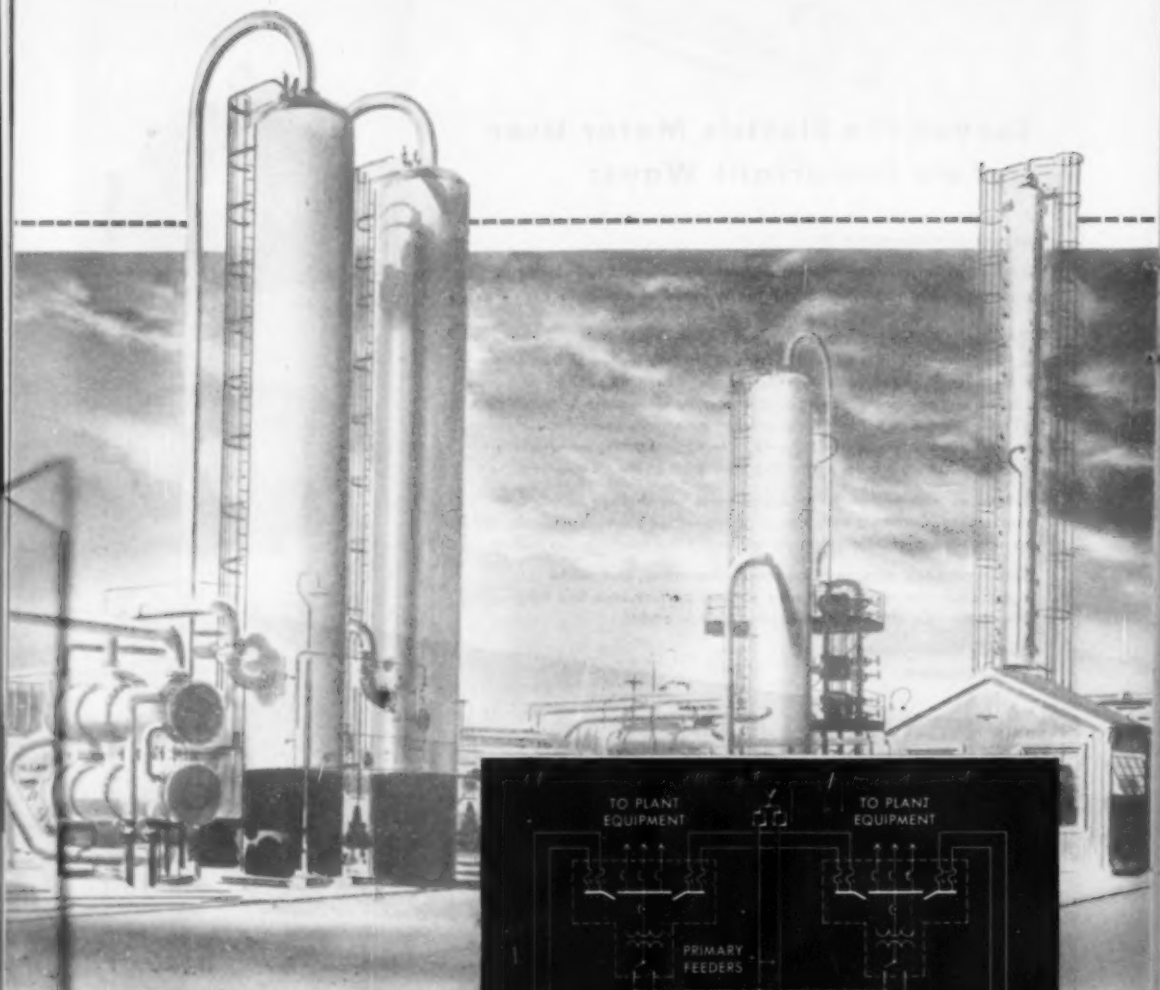
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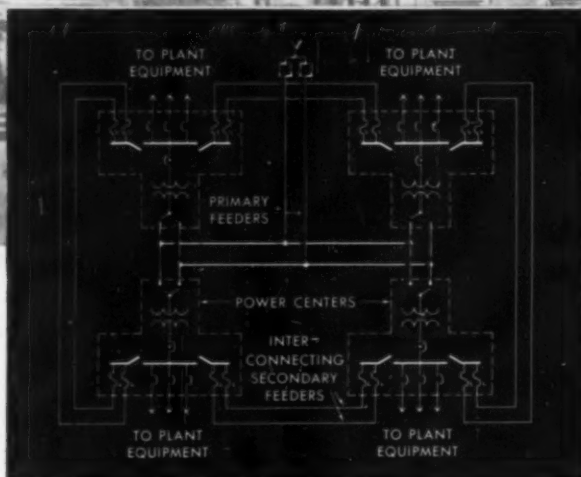


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This system rates high on service continuity and flexibility. Two Primary Feeders supply power. If a fault occurs on one, the other Feeder takes over to keep service continuous. If a fault occurs in a Power Center, its section of the plant is supplied by the adjacent Power Centers through the interconnecting Secondary Feeders.

When additional power is needed, one Primary Feeder supplies the plant while a new Power Center is connected to the dead feeder. The plant keeps operating.

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Probably more than you care to think about. But when power failure is at fault this costly threat can be eliminated. The answer:

A planned power distribution system!

When you modernize existing plants or build new ones, plan a system that *insures* service continuity . . . that gives you *alternate* power routes when electrical troubles occur. Moreover, make sure the system will be flexible . . . to permit load shifts and allow expansion without shutdown.

The Primary Selective Network shown on the opposite page is an example of a system that gives you this important service con-

tinuity and flexibility. But this is just one of the many systems you'll want to consider. Each has specific advantages depending on your particular operation. And Westinghouse can help you and your plant contractor design the system that *best* fits your requirements.

To help you make preliminary decisions we've prepared informative material covering all systems. Write for yours now. And remember, when you're building or modernizing, call in your Westinghouse engineers. With wide experience in power problems they can help you plan the one best system for your particular operation.

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"Industrial Plant Distribution Systems" 34 fact-filled pages completely explain the eleven basic systems. Ask for B-4045.

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- Capacity — 4500 lbs. per hr. (Dependent on material)
- Drum speed 1000 x G.
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- Construction as desired . . . alloy, rubber lined or iron and steel. Either fume or vapor tight.
- Fully automatic with cycle controller that handles every centrifugation cycle.

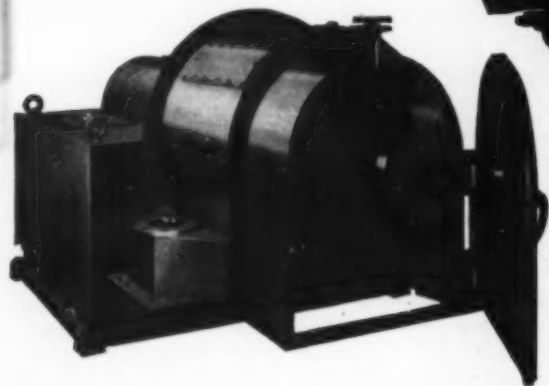
SIZE 16 JYEM2 UNIVERSAL MIXING AND KNEADING MACHINE for wide variety of chemical processing operations.

- Capacity 150 gallon working, 225 gal. total
- Sigma-type blades of cast steel
- 30 HP single motor drive
- Trough of fabricated steel jacketed for 80 lb. steam pressure.
- Vaulted, hinged and counterbalanced vapor-tight cover with quick opening clamp



SIZE 5-15 BAKER PERKINS "ter mear" CONTINUOUS CENTRIFUGAL for centrifugation of free draining crystalline, granular and fibrous materials of all types.

- Capacity — 6000 lbs. per hr. (Dependent on material)
- Drum speed — 450 X G Constant speed
- 20 HP single motor drive
- Drum diameter 15 inches
- Operates with continuous feed and discharge
- Lower Power input.



BAKER PERKINS INC., CHEMICAL MACHINERY DIVISION, SAGINAW, MICHIGAN

602

Why This Product Was Born

Goggles are a Safety Man's nightmare—when they're dirty. So are glasses. Every insurance company warns against the accidents, poor work, lost time and hazards that come from foul sight. Every indemnity premium-payer, production supervisor, or plant doctor knows the cost.

You would be willing to do most anything to make eye protectors more acceptable to employees—and more efficient. Yet goggles or glasses stay dirty and dangerous in plants and laboratories *unless you make it as easy as possible for workmen to clean them*. And that's the reason MAGIC LENS TISSUE and its simple Dispenser were born.

For, if you ask your working folks to use a rag, or ordinary fiber paper, lint and smears stick to most lenses. If you give them a small treated sheet, it tears and one sheet doesn't do the job. If you ask them to fuss with a cleaning fluid, time is wasted by this old-fashioned method, except in grimeiest operations. No wonder jumbo-size, super-strong MAGIC LENS TISSUE has swept the alphabet of industry from American Can to Zenith Radio.



©1951



Magic Lens Tissue
T.M. REG. U.S. PAT. OFF.
SILICONE TREATED

Each sheet is over 50% larger than usual . . . yet it costs you less. The paper is—without question—the finest that can be made . . . scientifically controlled at every step. It polishes as it cleans. As easy as lifting your finger. NO FUSS. NO WASTE. NO FLUID. NO COMPLICATED DISPENSER. See how dust, lint, dirt and smears vanish like magic and an invisible coating of silicone is deposited on the lenses, which protects them; gives longer clarity, gives sparkling crystal-clear sight, makes cleaning faster, easier, better, more lasting. It's General Electric Silicone—from the G.E. House of Magic—that does it; a combined development of the General Electric Company (Silicones Division) and ourselves against our background of 25 years in the pulp and paper industry.

The sheets reach you interfolded in instantly Ready-to-Use Refill Cartridges from our special interfolding ma-

chines; 800 super-strong, jumbo-size sheets per packet, 6 packets to the carton @ only \$1.40 per packet (\$8.40 per carton). The simple, single-operation, self-serving Dispenser has no moving parts. It's attractive, indestructible, secure; a credit to any plant, laboratory, engineering department or office. Solid 20-gauge cold rolled steel, beautifully enameled in National Safety Council green. Lock and key feature. Five year guarantee. Measures only 3½" x 7½" x 3½" overall. So compact you can place it elbow-close on-the-job wherever needed, to be used while workers remain at work without wandering around. And it is used because it is *easy* to use. Yet the Dispensers cost only \$2.50. All prices FOB our factories. Wire or write us, or order through your safety supplies jobber today. **GO MODERN—GO MAGIC.** A lot more safety for a lot less money. **COMPLETE YOUR INSTALLATIONS TODAY.**

The Silicone Paper Company of America, Inc.

General Offices: 230 Park Avenue, New York 17, N. Y.

Chemical plant saves \$40,000 a year in power costs!

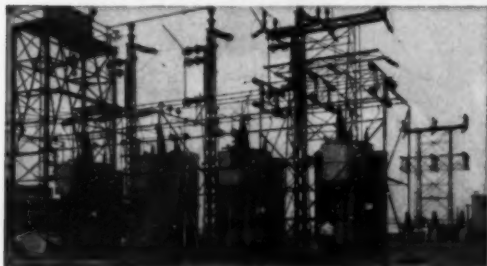


I Increased operating efficiency has been obtained by the installation of 3780 kva of 2400-volt G-E capacitors (two 1260-kva units shown) at this plant, which has a kva-demand clause in its power contract. In addition to correcting power factor, G-E capacitors can provide relief for overloaded circuits, or permit adding to fully loaded circuits.

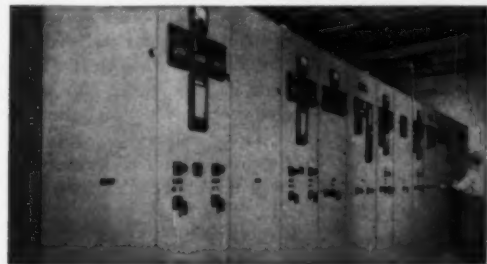
GENERAL  **ELECTRIC** 662-35

G-E capacitors—recently installed in large West Coast chemical plant—yield an estimated 50% annual return, increase efficiency of plant's power distribution system!

Savings realized by this company are just one example of the deep cuts that G-E capacitors can make in your chemical-plant power costs. Less dramatic, but vital to continuous production, is uninterrupted power supply. It's provided by reliable G-E power distribution equipment and co-ordinated to your individual needs by experienced G-E application engineers. For the whole story of the savings it makes possible, check your local G-E office—soon. *Apparatus Department, General Electric Company, Schenectady 5, New York.*



2 Incoming utility power is stepped down at these 4 G-E 5000-kva transformers from 112 kv to 22 kv for primary distribution throughout the plant. G-E transformers are available in all kva ratings and voltages to meet a wide variety of chemical-plant needs.



3 For continuity of power to vital loads, the plant uses a secondary selective system utilizing a 7500-kva 22,000/2400-volt G-E double-ended unit substation. Indoor portion shown is G-E metal-clad switchgear, a compact, assembled unit that saves installation costs.



4 Power losses are cut by G-E unit substations in load center systems. Shown here is the outdoor portion (two G-E 3750-kva transformers) of the plant's G-E unit substation that supplies power to miscellaneous compressor and motor loads located throughout the plant.



5 Conversion from a-c to d-c for electrolytic processes is provided by these two G-E Ignitron rectifiers, high in conversion efficiency, rated 3000 kw, 650 volts, 5000 amperes. Their control cubicles are shown in right foreground, and their anode circuit breakers in left background.



6 Centralized control for the G-E Ignitron rectifiers is obtained by means of this G-E switchgear and metering panel, where operator controls primary and rectifier breakers, and in addition obtains all necessary overcurrent relay, load current, and voltage indication.



**POWER
DISTRIBUTION
SYSTEMS**
for Chemical Plants

4

STRATEGIC ASSEMBLY POINTS

*to speed deliveries
of STABILFLO VALVES*

SAN FRANCISCO

DALLAS

FOXBORO

PITTSBURGH

The four sources of supply and service indicated above add another Foxboro plus value to the advantages of these unique process control valves. Each source is equipped to assemble Stabilflo Valves in a variety of sizes and materials to meet most specific needs . . . and staffed by expert application engineers and valve specialists.

Keep the nearest source of Stabilflo Valves in the back of your mind when lining up new control

valve applications or replacements. It's a Foxboro plus value that counts in profitable plant operation. Also get all the details on the following Stabilflo Valve features:

1. 50 to 1 rangeability with equal percentage flow characteristics
2. High lift V-Port: greater increment of lift for a given change in air pressure . . . and increased accuracy of positioning
3. Self-aligning, inverted-type motor—practically eliminates all sources of friction in motor action

4. High sensitivity of response
5. High force-friction ratio—negligible hysteresis
6. Vibration resistant
7. Rugged construction
8. Easily reversed action
9. Renewable seat rings

Compare Foxboro Stabilflo Valves point for point with other valves: (1) perfect response to every impulse of the controller; (2) minimum maintenance; (3) unequalled service. Write for Bulletin 272-2. The Foxboro Company, 384 Neponset Avenue, Foxboro, Mass., U. S. A. Branch offices in principal cities.

FOXBORO

REG. U. S. PAT. OFF.

AUTOMATIC CONTROL VALVES

Cleaver-Brooks Compression Distillation . . . The Most Economical Method of Evaporation

Here's Why:

The table shows the approximate costs of operation per 1000 gals. of evaporated water with a Cleaver-Brooks Compression Evaporator as compared with standard multi-effect steam evaporators.

OPERATING DATA	STEAM EVAPORATORS					Cleaver-Brooks Compression Evaporation
	Single Effect	Double Effect	Triple Effect	Quadruple Effect	Quintuple Effect	
Pounds water evaporated per pound steam input from boiler	0.9	1.75	2.5	3.2	4.0	—
Pounds steam required per 1000 gallons water evaporated	9250	4750	3325	2600	2070	200
Gallons condenser water required per 1000 gallons water evaporated	33,300	16,650	11,100	8,325	6,650	none
Steam cost per 1000 gallons water evaporated, based on steam at \$.80 per 1000 pounds	\$7.40	\$3.80	\$2.66	\$2.08	\$1.66	\$1.16
Condenser water cost per 1000 gallons water evaporated based on water at \$.10 per 1000 gallons	\$3.33	\$1.66	\$1.11	\$0.83	\$0.66	none
Electric Power Consumption per 1000 gallons water evaporated	10 KWH	6 KWH	6 KWH	6 KWH	6 KWH	60 KWH
Electric Power cost per 1000 gallons water evaporated based on power @ \$.01 per KWH	\$1.0	\$0.6	\$0.6	\$0.6	\$0.6	\$0.60
Total Water & Energy cost per 1000 gallons water evaporated	\$10.83	\$5.52	\$3.83	\$2.97	\$2.38	\$0.76

The concentrating of chemical solutions for valuable recovery or for disposal can be done economically with compression distillation.

The recovery of pickling liquors, the concentration of waste proteins, the concentration of waste pulp liquors, are just a few of the process problems which can be solved through vapor compression distillation at less cost.

Cleaver-Brooks is constantly called upon to evaluate chemical process problems in terms of the vapor compression cycle.

After a complete analysis of your process problem, a Cleaver-Brooks compression still is constructed to meet your specific needs. Com-

plete consideration is given to the type of raw liquid to be evaporated, the capacities of your allied equipment, the future growth of your plant operations, and the use or uses of the products to be distilled or concentrated.

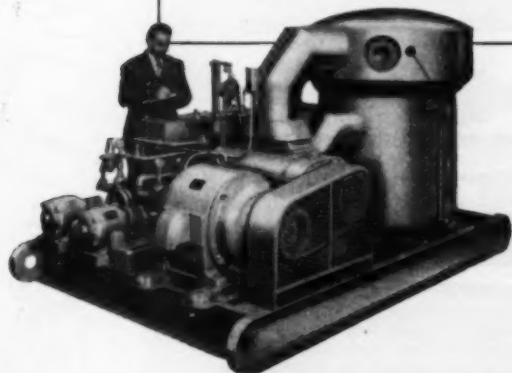
It will pay you to consider now the value of compression distillation in your plant for purification or recovery or disposal.

Write for bulletin:

"Compression Distillation"

Cleaver-Brooks Company

331 East Keefe Avenue
Milwaukee 12, Wisconsin



Consider Compression
Distillation for Purification...
Recovery...Disposal

Cleaver-Brooks

Builders of equipment for the generation
and utilization of heat.



A Big Forward Step In The

INTRODUCING



Easy Field Calibration
- without water column



No Strainers
Required.



Easily
Cleaned



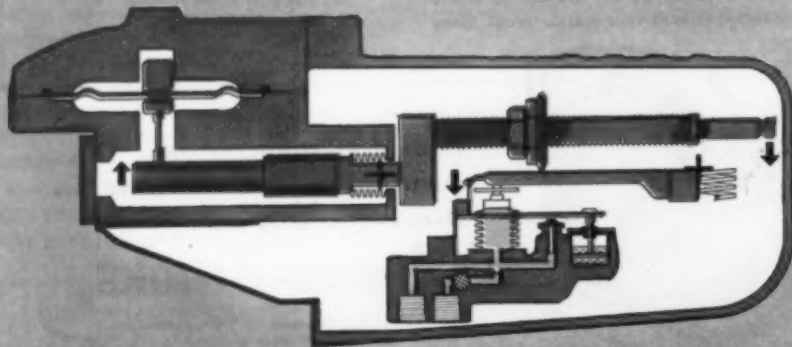
Wide Rangeability
- in one unit, 20 to 200" H₂O



Easy to
Install



Fast Speed
of Response



FUNCTIONAL SCHEMATIC CROSS-SECTION . . . Diaphragm, at upper left, separates low and high pressure chambers and is connected to primary beam. Movement at diaphragm acts upon secondary beam through contact of rider (range change adjustment). Secondary beam moves flapper toward nozzle, causing pressure to build up in balancing bellows . . . thereby creating upward force to balance differential pressure. This entire sequence of actions is practically instantaneous.

Measurement and Transmission of Flow

the New

BROWN DIFFERENTIAL CONVERTER

(pneumatic-balance flow transmitter)



AFTER long and rigorous testing in the field, the Brown Differential Converter is ready to set new high standards of simplicity and precision in the measurement and transmission of flow.

Operating on the pneumatic-balance principle, this compact and light-weight unit converts differential pressure at the orifice into a proportionate output air pressure which is a measure of flow. All adjustments . . . such as the range change which is continuous from 0-20 inches of water up to 0-200 inches of water . . . are easily and simply made, without special tools or extra parts.

Applicable to a wide range of continuous processes, the Brown Differential Converter is the fore-runner of an entirely new series of pace-setting developments made possible through Brown *Creative Instrumentation*. For detailed information write for a copy of new Catalog No. 2281 . . . and call in our local engineering representative for a discussion of your process needs. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Industrial Division, 4478 Wayne Avenue, Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell

BROWN INSTRUMENTS

Get full rpm transmission...

Silverstreak Silent Chain does the job with a single strand—eliminating the dangers that come with one or more belts in a group carrying more than their share of the load.

Husky Silverstreak metal link construction combines the ability to carry heavy overloads with the resilience that really absorbs shock.

"Pull" is distributed equally across Silverstreak Silent Chain. No possibility of uneven running—slapping.

Silverstreak Silent Chain doesn't rely on tension to get pulling power—chain meshes with teeth—gives POSITIVE drive—no chance for slip.

LINK-BELT Silverstreak Silent Chain Drives

**Slip-proof
Slap-proof
Shock-proof**

TAKE the proven road to increased production—through the best in high-speed power transmission. You'll find Link-Belt Silverstreak Silent Chain Drives are 98.2% efficient. With normal maintenance, you have a *positive* drive that runs for years and years.

And note this important point—on extremely short centers Silverstreaks lose none of their efficiency. What's more, reduction ratios as high as 10-to-1 are frequently used. Both of these Silverstreak features save you valuable space.

One test will prove to you why thousands of production-minded engineers have standardized on Link-Belt Silverstreak Silent Chain Drives.

LINK-BELT

SILVERSTREAK SILENT CHAIN DRIVES

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in principal cities.



PICCOUMARON

Para-Coumarone-Indene

RESINS

A GROUP OF THERMOPLASTIC SYNTHETIC RESINS USEFUL FOR:



PAINTS



INKS



WATERPROOFINGS



CONCRETE CURING



CHEWING GUM



VARNISHES



RUBBER COMPOUNDS



ADHESIVES



FLOOR TILE



WAX COMPOUNDS



LACQUERS



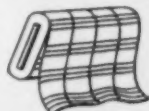
ANTI-RUST COATINGS



CEMENTS



HOT MELTS



TEXTILES

The applications shown above indicate some of the almost endless uses for this excellent resin.

Piccoumaron Resins are available in grades from liquids to brittle solids. Colors vary from pale yellow to deep reddish brown. They are soluble in coal tar, turpentine, terpene and most chlorinated solvents. Good resistance to acids, alkalies and salt.

Write for samples and complete data on PICCOUMARON Resins.



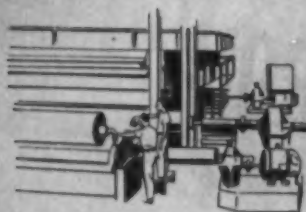
PENNSYLVANIA INDUSTRIAL CHEMICAL CORP.

Clairton, Pennsylvania

Plants at

Clairton, Pa.; West Elizabeth, Pa.; and Chester, Pa.

Distributed by Pennsylvania Bulk Chemical Co., Pittsburgh 30, Pa.
and Harwick Standard Chemical Co., Akron 3, Ohio



...the Electrical Transmission

which gives you

STARTING without clutches!

STOPPING without mechanical brakes or clutches!

REVERSING without use of gears or clutches!

ADJUSTABLE SPEEDS without mechanical transmissions or change of gears!

JOGGING, INCHING, CREEPING without slipping clutches!

... from A-c. Circuits

Call your nearest Reliance Application Engineer or write today for Bulletin 311 (V*S Drives through 200 horsepower).

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Smaller Reliance V*S Drive, in sizes from 3/4 to 3 horsepower. Performs all the functions of mechanical transmissions—electrically!



RELiance ELECTRIC AND ENGINEERING CO.

1063 Ivanhoe Road, Cleveland 10, Ohio

• Sales Representatives in Principal Cities

Extra Value for Esso



This MEK Dewaxing Unit, recently completed at Bayonne, N. J., for Esso Standard Oil Company, is the largest and newest of three such units which Badger has recently designed and constructed for Esso and an affiliated company. Improvements and modifications in each successive unit have provided extra values for Esso, in lower initial cost, earlier completion, more economic operation and easier maintenance.

Badger's broad experience in the design and construction of every type of petroleum and chemical unit means extra value for all Badger clients.

MEK
Dewaxing Unit
with charge capacity up
to 7500 BPD, designed, engi-
neered and constructed by Badger
for Esso Standard Oil Company at
Bayonne, N. J. Process licensed by
Texaco Development
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E. B. BADGER & SONS CO. • Est. 1841

A SUBSIDIARY OF STONE & WEBSTER, INC.

BOSTON 14 • NEW YORK

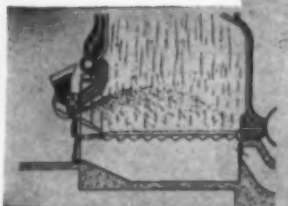
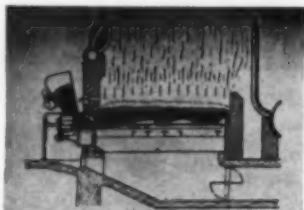
PARIS Etablissements **LONDON** F. B. Badger & Sons
Badger S.A. (Great Britain) Ltd.

Process Engineers and Constructors for the Petroleum, Chemical and Petro-Chemical Industries

For every fuel market and every type of load there is one best method of firing. The selection of that one best method for the fuel and load conditions of a particular plant calls for judgment based on broad experience and free from any incentive to favor one type of fuel burning equipment over another.

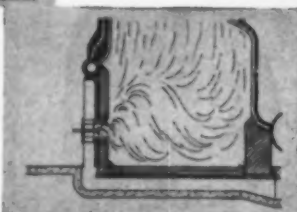
The Type VU-10 Boiler is designed for five fully standardized methods of firing—spreader stoker, single-retort underfeed stoker, chain grate stoker, oil or gas burners. The furnace design is such that any of these methods may be substituted for any other should a change in the fuel market make it advantageous.

TYPE E UNDERFEED STOKER



OIL OR GAS BURNERS

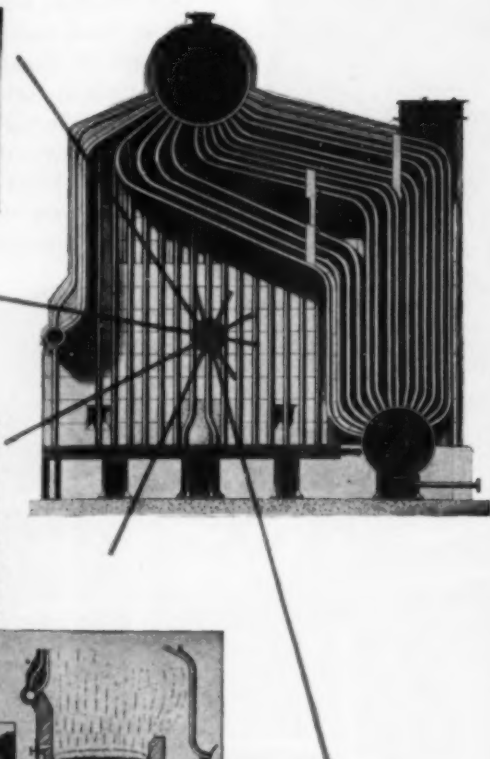
SPREADER STOKER



SKELLY UNDERFEED STOKER



CHAIN GRATE STOKER



C-E Vertical-Unit Boiler TYPE VU-10

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Why buy a Boiler Unit piecemeal?

A piecemeal boiler unit is one in which some of the major components are purchased from different manufacturers.

There is no assurance . . . certainly no protecting guarantee . . . that the resulting assembled compromise will meet your performance requirements. If you buy piecemeal, you must accept the uncertainties inherent in divided responsibilities for overall results.

That is why it will pay you to investigate the Vertical-Unit Boiler, Type VU-10. Here is a completely integrated unit . . . boiler, water-cooled furnace, setting and fuel burning equipment . . . available from one manufacturer — Combustion Engineering—Superheater—a recognized leader in both the fields of fuel burning and steam generation. From the initial design stage, the relationship of

each of the components, one to the other, has been so developed as to provide the highest possible degree of correlation and standardization. And . . . of prime importance to the buyer . . . the overall performance is underwritten by the C-E sales policy of "one contract, one guarantee, one responsibility."

So—buy your next boiler as a *complete* unit . . . the VU-10. Enjoy the peace of mind that comes from the knowledge that you have an installation for which one manufacturer—Combustion Engineering—Superheater — is responsible for fulfillment of performance guarantees. Moreover, you will be able to count upon a reliable source for whatever service or spare parts you may require during the many years that represent the useful life of a modern steam generating unit. B-440

— **SUPERHEATER, INC.**

200 MADISON AVENUE, NEW YORK 16, N. Y.





Life-line motor
PAIRED FOR PRODUCTION
Life-line starter



REGISTERED TRADE MARK

CORROSION ?

Beat it with this Bonderized pair

You can install this Life-Line chemical motor and Life-Linestarter® team, any place and be sure. They're tough, dependable. Extra-protected, inside and out, and Bonderized to beat off corrosion's attacks. Look at the motor, for example.

Its specially treated, rolled-steel frame constantly has proved its ability to outlast conventional frames. Why?

In the first place, the frame is heavy-gauge, Bonderized steel. Then, special formaldehyde-alkyd-type enamel and succeeding layers of Thermoset varnish plus final lacquer are applied. That makes a tough hide to ward off corrosion's sabotage.

Too, Life-Line pre-lubricated, factory-sealed bearings guard against acid and other bearing enemies. This one feature alone has doubled

bearing life... multiplied it many times in some plants. Lubrication maintenance is eliminated.

Life-Linestarters are also Bonderized—the only standard Bonderized starter available today at no extra cost. That's why, in corrosive atmospheres, the Life-Linestarter has rendered substantial savings to users. In places where local electrical codes formerly specified expensive, hot-dipped galvanized or cadmium-plated enclosures, the Life-Linestarter is now acceptable.

Together, you can't beat this team for corrosion resistance. Put them together on your applications and save. Discuss the details with your Westinghouse representative. He has the facts to help you stop corrosion raids. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21630

YOU CAN BE SURE... IF IT'S
Westinghouse

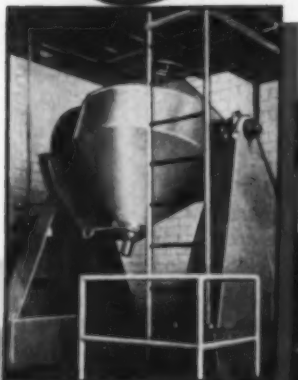
Life-Line

MOTORS and CONTROLS

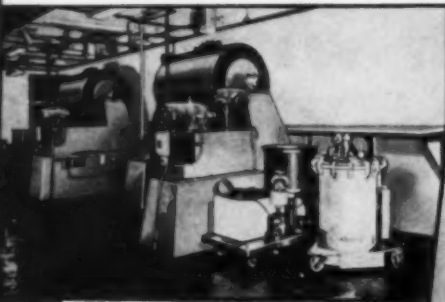


put *International*

TO WORK IN YOUR PLANT
TO CUT COST AND
IMPROVE PRODUCTION



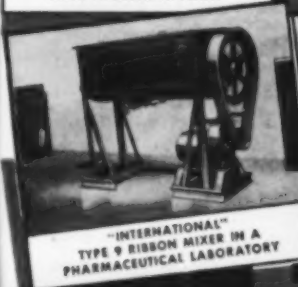
"INTERNATIONAL"
TYPE 6E DRY BLENDER IN A
FOOD PROCESSING PLANT



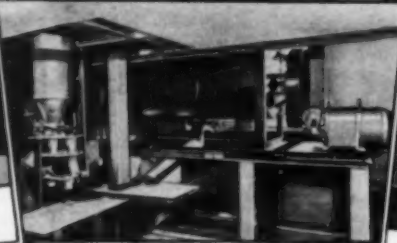
"INTERNATIONAL" BALL MILLS IN AN
ENAMELING PLANT
(No. 5 DRIVE ARRANGEMENT)



"INTERNATIONAL" AGITATOR
INSTALLED IN FISH CANNERY
COOKER



"INTERNATIONAL"
TYPE 9 RIBBON MIXER IN A
PHARMACEUTICAL LABORATORY



"INTERNATIONAL" RIBBON MIXER IN A PLANT
MAKING AUTOMOTIVE RADIATOR SOLVENTS
AND CLEANING COMPOUNDS



"INTERNATIONAL"
SIDE ENTRANCE MIXERS
HOPPER CAR INSTALLATION



"INTERNATIONAL"
PORTABLE MIXERS IN A
GELATIN PRODUCTS PLANT

INTERNATIONAL PROCESSING EQUIPMENT is the logical answer to problems of Blending, Treating, Mixing and Grinding of Chemical components in any desired size, capacity or requirement

Remember—"INTERNATIONAL" Builds and Guarantees the equipment you need to get more production at lowest operating cost. Ask for Special Catalog and complete information on any equipment, today. No obligation, of course.

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TYPE
"SGR"

Top Entering
AGITATOR



"I wrote 42 firms, got 28.4 cu. ft. of bulletins," says Julian Smith . . .

Author of Our Glass Report

I was chatting with Herman Zabel of Chemical Industries Week one day last September about new developments in chemical processing equipment.

"Funny thing," Herman said, "there's never been published—at least for several decades—an honest-to-God, comprehensive report on glass and glass-lined equipment. The kind, you know, that tells chemical engineers where, why and how they can use it in their plants."

"Then that's something I'm going after for *Chemical Engineering*," I said. The more I scouted around the more I found out that there was a real need for such a report.

Several weeks later Julian Smith (associate professor of chemical engineering at Cornell) dropped in. I asked him what he thought about the idea, if he knew anyone who'd tackle the job.

"Me!" he came right back. Then he told me why—and I knew we had the right man.

When Julian's report (p. 117) came in, I asked him to tell me something about how he did it. Here's his answer:

"I knew there was a need for up-to-date information on glass equipment and where it can be used. I've been doing consulting work for a glass equipment manufacturer for years, so

it was easy for me to get hepped up on the subject. From my own experience in industry (with Du Pont in plant operation, engineering and design from 1942 to 1946) I knew what was needed most—practical dope, not the research or literature review type of stuff.

"First I looked through every directory I knew to find out who makes the equipment for large-scale processing use. I wrote every one of those companies (42 in all) and asked for their literature. Most of them answered that they don't actually make the equipment. That taught me something: don't trust directories too much.

"Actually, my report is based largely on the information—some 28 cu. ft. of it—sent in by 18 companies. Believe me, my postman isn't friendly any more!

"I worked largely from advertising and promotion literature. It's really the best source of information: up-to-date, aimed right at the fellow who uses the equipment, comes first-hand from the people who know most about the subject. It's surprisingly reliable, too. On the other hand, most of the published articles before 1940 are now completely out of date. There haven't been many since then.

"Next I classified, read and evaluated my Five Foot Shelf of company

bulletins. That job took weeks (I hate to think of how many). But it was interesting, for I learned a lot of new things about glass.

"Then I visited several of the manufacturers to clear up questions and get more dope. The cooperation of some of the companies bordered on the remarkable. I also got a lot of samples (see picture). Then I checked my information against my own experience and with several engineers who have put a lot of glass equipment into their plants.

"Finally I had to buckle down and write the piece because your editor Chilton (damn him!) really kept on my tail. That took about 25 hours and 65 sheets of paper.

"As soon as I'd finished the job and mailed it to you I went back to one of my favorite samples—a glass bottle. After a couple of hours there wasn't a drop of rye left."

In spite of what Julian says, I know he gets a kick out of doing these "equipment round-up" reports: less than a week later he signed up to do another one for us later in the year. Actually, Julian has written some 23 articles for American and British technical journals (four were published before he got his chemical engineering degree from Cornell in 1942).

Since teaching, engineering and Cornell about sum up Julian's ancestral background, he decided in 1946 to combine all three and teach chemical engineering at Cornell. His courses are equipment design, unit operations lab, advanced heat transfer, with plant design and research projects. Says Julian: "My wife Joan, who used to work in Du Pont's purchasing department, knows more chemistry and engineering—without any formal training—than many of my students."

Julian's father, an electrical engineer, went to Canada "temporarily" in 1902, stayed until he died in 1939. He was then president of Shawinigan Water & Power Co. Julian was born near Montreal. Because of conflicting laws, he could be either an American or Canadian without naturalization. As it turned out, Julian and one sister became Americans, another brother and sister Canadians.

Pollution Control . . .

. . . will be the subject of our next month's big special report. It will tell why there is a problem, what the problem is, how to solve it.

How to Get Steel for Maintenance and Repairs *use NPA Regulation No. 4*

Any business—large or small—may now use a DO rating to obtain limited quantities of steel for maintenance, repairs and minor capital additions. The rating to apply is DO-97 as authorized by the NPA's new Regulation No. 4.

Obviously the use of this rating does not automatically get the steel because it is impossible to maintain complete stocks under present conditions. However, it does assure your order of preference over unrated orders and equal treatment with all other orders bearing a priority rating. If we have the steel you get it. Moreover, we can in turn extend

the rating which should help us to maintain stocks for your future needs.

Because of broken stocks, we suggest you give us alternate sizes, gauges and qualities that would be acceptable. In this way you increase the chances of getting steel you will be able to use.

And remember, if your order falls within the provisions of Regulation No. 4 take advantage of it—use your rating! You can be sure that we will make every effort to take care of you as promptly and fully as possible.

If you do not have this Regulation No. 4 we will be glad to send you a copy.

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Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

APRIL 1951

Building Our Way Out

Industry came out of World War II imbued with one idea: to apply all that science and technology has taught us to the job of building a greater America. While governmental economists dismally predicted a postwar depression, the five years, 1946-1950, saw private investment in new plants and equipment climb to \$65 billion. Our standard of living, measured by gross national production, mounted steadily although the military burden had dwindled to less than 10 percent of the total. Now all this must be changed to meet an entirely different situation at home and abroad.

For at least the next two or three years we must live in an "arsenal economy," where rising military production takes precedence over most civilian industries. We must quickly strengthen our defense, prepare for the eventualities of war against aggression. Yet we are surely courting defeat if at the same time we do not make full use of our engineering resources in providing for further expansion of the whole of our economy.

Fortunately, the chemical process industries have always been "expansion-minded." They have led rather than followed in opening up new markets for the products of their aggressive research and technology. They carried their share, and more, of the war-time projects that gave us synthetic rubber, high explosives, vital medicinals—even the atomic bomb. After the war, they led all manufacturing industries in their capital spending.

So it is not surprising to find that "Chemicals" is at the top of the list in McGraw-Hill's fourth annual survey of business plans for new plants and equipment. (See page 259) Chemical industries plan an outlay of \$2,140 million in 1951—almost 60 percent more than 1950, and 50 percent above the peak postwar spending in 1948. Petroleum refining will add almost another billion dollars—a 42 percent gain over last year. In terms of increased capacity, this will provide for chemical production three-and-a-quarter times that of 1939—up 11 percent within the current year. Surely, here is part of the answer to the problem of serving

war production, at the same time helping in the fight to preserve our living standards.

The McGraw-Hill Department of Economics has come up with other statistics intensely interesting to chemical engineers and executives. For instance, there has been a marked shift of emphasis to plant expansion rather than for replacement and modernization. Again chemicals lead the list with 80 percent going for new plants as compared with 75 percent last year. However, even with the greater share earmarked for expansion, the 1951 budget for modernization and replacement will top 1950, simply because the over-all investment will be so much larger. In other words, there will be no letup in the pressure for more efficient machinery to conserve manpower and materials.

Where will the money come from? In the case of chemical industry, 91 percent of it will come from its funds, from retained profits, depreciation and other reserves. Only 3 percent will come from the sale of stock despite the industry's strong position in the security markets. As will steel and other industries on which defense demands are greatest, chemical manufacturers are asking for accelerated amortization on a large proportion of their construction program. Yet none reported dependence on government or governmental guaranteed loans.

As in all planning, personal or business, there are important "ifs" in the present programs. Our economists warn that all of these projects may not be fully realized. With military production rapidly mounting, there will be increasing competition for equipment, materials and manpower. Construction costs and the prices of capital goods are already 10 percent above those of a year ago and they may go even higher. But it is our guess, based on experience with the three earlier surveys, that these estimates will pretty well reflect the trend of capital investment in the remaining months of 1951. They offer real encouragement for those who believe, as I do, that we can build our way up and out of the arsenal economy.

Sidney D. Kirkpatrick

HOW VIRGINIA-CAROLINA MAKES PHOSPHORUS BY

Sound Engineering One Unit Process Four Unit Operations

JOHN R. CALLAHAM

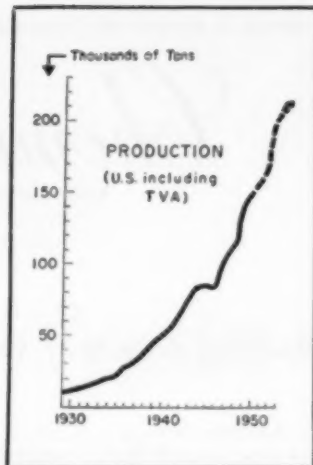
Bob Kean was mighty proud of the way Virginia-Carolina's new phosphorus unit was performing. That was obvious as he showed me through every nook and corner of the Charleston plant, the way he answered all my questions, gave without hesitation every figure I asked for (knowing that editorial ethics would keep me from publishing those I shouldn't).

EDITOR JOHN CALLAHAM made a flying trip to his native state, ate plenty of she-crab soup, hoppin' John and other Low Country dishes, came back with this story of Virginia-Carolina Chemical Corp.'s phosphorus operation at Charleston, S. C.

I soon learned why: although there's nothing revolutionary about how the unit is designed or operated, it smacks throughout of smart planning and sound engineering. Little tricks—and some that aren't so little—have slashed capital investment, improved recoveries, increased energy efficiencies, cut operating costs.

All these little things add up to one big one: Even though V-C's a newcomer to the phosphorus field and a relatively small producer, it can—and is—"turning out the stuff at a cost as low as any producer in the United States," as Pete Cox put it.

Here's how smart planning and sound engineering have made V-C's



WHY—"Look at this phosphorus curve, especially the dots. A field for us!"

phosphorus operation of Charleston a success.

Sound Engineering

► Smartest move of all was to get into the field as a prime producer. Two good reasons lay behind this decision: (1) V-C could make the phosphorus it needed to produce its line of phosphoric acids and chemical phosphates; (2) the field was a growing one with room for another producer (see chart).

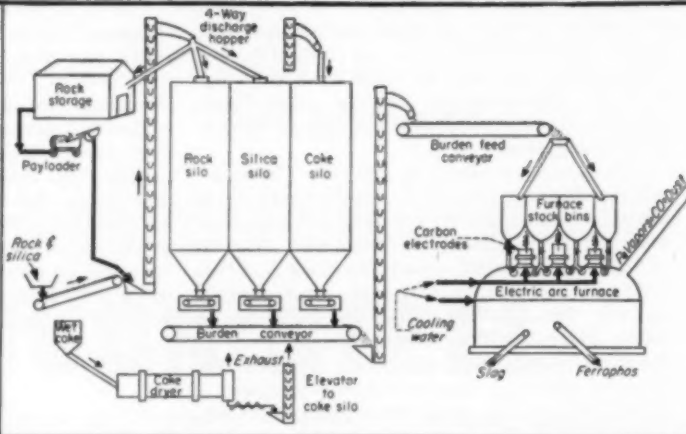
For years V-C had bought phosphorus to make high-purity phosphoric acids, di- and tri-sodium phosphates, tetrasodium pyrophosphate, sodium tri-

HOW—Process used at Charleston: (1) phosphate rock, silica and coke are fed to electric arc furnace; (2) mix is reduced

What Goes In . . .

PHOSPHATE ROCK	7.25 tons
SILICA PEBBLES	2.66 tons
COKE	1.43 tons
ELECTRICITY	11,850 kwh.
WATER	3,000 gal.
ELECTRODES	.30 lb.

. . . per Ton of
Phosphorus Product





and op-
railroads
officer of
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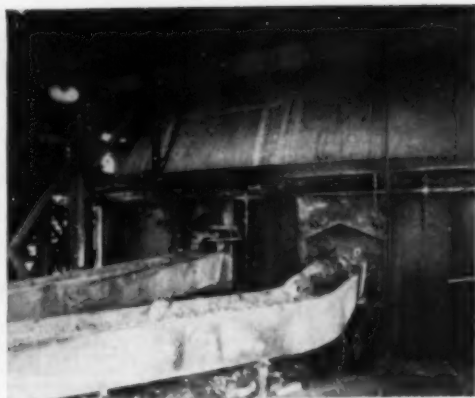
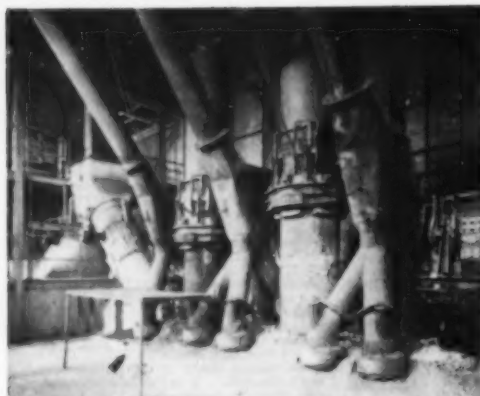


surgical and
project a suc

► Third smart move was to keep down electric energy costs. These normally amount to 30-35 percent of the total

[illegible]

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ONE UNIT PROCESS (reduction) takes place here. Top of the arc furnace is shown at the left and bottom at the right.

cost of producing phosphorus, the largest single item in its manufacture.

Charleston was picked because the Santee-Cooper Project has made it one of the nation's low-cost power areas. It does this, even though the area is flat and on tidewater, by shunting water from the Santee to the lower watershed of the Cooper. Charleston is the low-power area nearest to Florida rock.

V-C engineers have seen to it that the power factor for the furnace operation is high. The transformer was placed as near to the furnace as possible so that its secondary leads are very short. Steel circuits were avoided; there are no steel loops around the secondaries. Induced currents are thus practically eliminated. This unusually high power factor cuts down energy costs appreciably.

V-C operates its furnace at a high voltage—significantly higher than the 220-280 v. common in the industry. This gives an energy efficiency roughly 10 percent higher than normal. Since the current density is less, smaller electrodes can be used.

Most important result of high voltages is the lengthened life of the furnace hearth. This is made of carbon blocks cemented with carbon paste; normal life at 280 v. is two years or more. Complete replacement requires a six-week shutdown that would cost at least \$400,000, including the loss of production.

► V-C decided to do most of its own engineering work. This was a bit bold: the company's engineering staff was small, its experience in making phosphorus limited to operating a pilot plant furnace at Nichols, Fla., for nearly three years.

Yet construction went ahead smoothly and at a fast clip—eight

months from breaking ground to initial operations in April 1950. What has been more satisfying is that the 12,000-kva. plant is already operating above—and well above—its design capacity.

With limited knowledge of what might be called "sound practice," V-C's engineers struck out and designed according to "sound engineering." In doing this they came up with a number of smart engineering tricks. ► Some phosphorus plants condense their P₂ vapors by chilling them with a countercurrent flow of water sprayed in at the top of a tower. The Germans even use complicated mechanical devices. This isn't necessary, reasoned V-C's engineers, as (1) heat transfer is simpler to handle than the mechanical separation of condensed phosphorous, and (2) economy of water is not important as it is recirculated anyway.

"If we use co-flow," they figured, "we'll need less of that big, expensive steel gas line; we'll have the gas flow, water flow and gravity—all three—working with us for better phosphorus separation; the entire piping layout will be simplified." This figuring saved close to \$5,000-\$6,000 in piping costs.

► High-tension equipment of the electrostatic precipitator must be cooled with plenty of clean air. But nowhere in the plant area was the air clean enough of dust and fumes for this use. The V-C solution: take the air right off the top of the cooling tower where it (1) is freshly scrubbed and about as clean as it can be, (2) is at least 15-20 deg. cooler than anywhere else, and (3) will cause no trouble with condensate since its relative humidity drops as it travels toward the precipitator.

► Materials handling is a major unit

operation at the plant. Over 500 tons of phosphate rock, silica pebbles, coke and furnace burden are handled daily—mostly by bucket elevators.

"We've had years of hard-won experience handling bulk fertilizer materials. Why can't we capitalize on this and assemble our own bucket elevators and conveyors?" They did—and saved \$30,000-\$40,000.

► For every ton of phosphorus, over 7 tons of byproduct slag is produced. This stuff has a low value as road ballast, yet it's troublesome—and expensive—to break up, grind and handle.

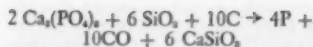
V-C smartly eliminated this problem. The slag is simply run off and chilled with water. Since road-bed gravel commands a premium in this gravel-less coastal plain, an outside company jumped at the chance to come in, pick it up with power shovels and take it off V-C's hands entirely.

► Some phosphorus plants place their product storage tanks underground. But it's just as safe—and much cheaper—to support them above ground over a concrete basin filled with water. Any phosphorus from leaks or spills (which certainly aren't expected) would be quenched at once in the water. And besides, the valuable product could be recovered.

One Unit Process

Reduction in the furnace reaction is the only important unit process in making phosphorus. Here phosphate rock is fused and reduced to phosphorus, carbon monoxide and slag*:

* This equation is oversimplified, actually erroneous; the formula is nearer $\text{Ca}_3\text{P}_2(\text{PO}_4)_4$ than $\text{Ca}_3(\text{PO}_4)_2$. The CaO and P_2O_5 are always associated with Fe , Si , $2(\text{OH})$ or O combined in the crystal lattice. In rock something around 3 percent has chloride, hydroxyl or oxide substituted for the fluoride.



Heat for the fusion is furnished by the carbon electric arc furnace; temperature in the reaction zone is 2,500-2,600 deg. F. The iron in the phosphate rock is reduced, reacts at once with phosphorus to form ferrophosphorus. Fluorine, potassium, sodium and some silica are volatilized along with the phosphorus. Fluorine in the gases exists as HF at high temperatures, as SiF₄ at lower temperatures.

Conditions in the furnace are controlled by (1) drying the charge; (2) proportioning the burden constituents properly; (3) maintaining a large reaction zone at optimum temperature; (4) keeping air out.

Drying the charge prevents the sudden evolution of steam near the furnace top; this would drive off unreacted charge as dust into the exit gases, lower the yield and overburden the electrostatic precipitators. Besides, electric energy is entirely too expensive to be used for driving off water!

V-C phosphate rock is dried at the mine to about 1.5 percent moisture; the hard silica pebbles have so little moisture it isn't necessary to dry them. The coke, variable in moisture content, is dried to less than 1.0 percent water.

It's important to proportion the burden properly; upon this depend (1) phosphorus yield, (2) slag characteristics, (3) losses in ferrophos and (4) general performance of the furnace.

Burden composition, calculated daily, is based largely on continuous slag analyses. In general, the rock-silica-coke proportions should be adjusted so as to give a slag with a SiO₂:CaO ratio of 0.75-0.90. Such a slag has a low melting point yet is acid enough to flux off all basic constituents of the charge. For normal operations, V-C charges a burden with a rock-silica-coke ratio of 1.0-0.38-0.20. The rock averages close to 80 percent BPL.

Reaction zone in the furnace is controlled largely by input voltage and by automatically raising or lowering each carbon electrode to maintain uniform electrical characteristics. By using a high voltage (as already mentioned, V-C goes much higher than the 280 v. common in the industry) the reaction zone is extended.

Net result of higher voltage is to (1) increase the capacity of the furnace, (2) raise the energy efficiency, (3) cut down electrode consumption and (4) lengthen the life of the furnace hearth. Electrodes are consumed at the rate of about 30 lb. per ton of phosphorus product.

What Materials of Construction Are Used

Equipment	What It's Made Of
Materials Handling	
Raw materials bucket elevator	Steel
Raw materials unloading hoppers	Steel
Raw materials storage silos	Concrete
Furnace burden conveyor	Rubber
Furnace stock bins	Steel
Precipitator dust screw conveyor	Steel
Reduction Furnace	
Outer shell	Steel
Crucible	Carbon blocks; carbon paste
Roof	Castable refractory
Slag tap cooler	Brass
Electrode holder	Non-magnetic alloy
Electrode gland and seal	Non-magnetic alloy
Exit gas duct	Steel
Separations	
Electrostatic precipitator	Steel
Precipitator dust receiver	Steel
Dust conditioner	Steel
Phosphorus vapor condenser	Steel
Condenser gas duct	Steel
Fluids Handling	
Phosphorus sump pit	Concrete, acidproof brick
Liquid phosphorus pumps	Brass; stainless steel shaft
Phosphy water pumps	Brass; stainless steel shaft
Hydropumps	Brass
Phosphorus separator	Herculoy
Condenser water lines	Red brass
Phosphorus metering tanks	Steel
Phosphorus metering cocks	Iron
Phosphorus storage tanks	Steel
Water cooling tower	Redwood

Air should be kept out of the furnace; otherwise, the phosphorus vapors oxidize at once to P₂O₅. This causes trouble in the precipitator system and cannot be recovered as elemental phosphorus. The furnace is made as airtight as possible. Main leakage is around the sleeves of the sliding electrodes. Some loss of phosphorus vapors occurs here, especially as a fresh charge surges into the furnace.

Furnace pressure and temperature, as well as operating conditions throughout the plant, are automatically controlled in an air-conditioned control room near the furnace. Charging of raw material is automatically controlled in relation to electric current to the furnace. The one operator here can tell at a glance what's going on in the entire plant.

Gases leave the furnace through a magnesite-insulated steel duct that leads to the electrostatic precipitator. Their temperature is about 650 deg. F. They consist of CO, phosphorus vapors and smaller amounts of K, Na, F, and SiO₂. Close to 3.3 tons of gases (about 85 percent CO) are produced for each ton of phosphorus product.

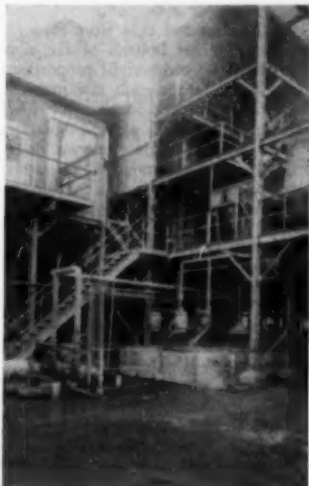
Slag and ferrophosphorus are tapped intermittently through 2-in. holes near the bottom of the furnace. The FeP, being heavier, is tapped about 6 in. below the slag.

About 0.09 tons of FeP is produced for each ton of phosphorus product. It analyzes 25-28 percent phosphorus. The molten ferrophosphorus is simply run out into a small brick-lined pit, allowed to cool, then broken up into lumps and sold to steel mill operators.

Some 7.1 tons of CaSiO₃ slag is formed for each ton of product. It contains about 0.7 percent phosphorus. Molten slag is run into an earthen pit, cooled with a stream of water and broken up after it solidifies. It's used as a road ballast.

Normal over-all yield of phosphorus product is 89-90 percent. Almost 55 percent of the losses occur in the slag and ferrophosphorus.

Crucible of the furnace is made of carbon blocks cemented with a carbon paste. The entire crucible, after baking, becomes monolithic in structure.



FLUIDS HANDLING—Pumps, pipes & pits for phosphorus and phosphy water.

Four Unit Operations

V-C uses four unit operations in making its phosphorus: (1) materials handling, (2) heat transfer, (3) separation and (4) fluids handling.

Materials Handling—This unit operation is used in handling phosphate rock, silica pebbles, coke, furnace burden, electrodes and—to a minor extent—packaging. For every ton of phosphorus produced, over 11 tons of raw materials must be handled.

Since it takes 7.25 tons of phosphate rock to produce a ton of phosphorus, handling this raw material is an important operation. Rock arrives

in hopper-bottom cars, is dumped into an unloading hopper and conveyed by a standard steel bucket elevator to a 7,100-cu. ft. concrete silo. The bucket elevator is 70 ft. high, has a speed of 150 ft. per min. and a capacity of 80 tons per hr. Uses a 15-hp. motor.

This same elevator and unloading system is also used for silica pebbles and coke. A four-way discharge hopper and gates send the raw materials to one of the three concrete silos; it can also send phosphate rock to the rock storage building. A Payloader takes it from this building, as needed, and dumps it back into the elevator feeding the storage silo. This system allows (1) flexibility in handling and storing varying tonnages of the raw materials, (2) maximum handling operations with a minimum of handling equipment.

Wet coke is first sent to a hopper feeding an oil-fired rotary dryer; dry coke is then carried by bucket elevator to the coke silo.

Rock, silica and coke drop through the gates at the bottom of the silos into Merrick Feedweight proportioners. These deliver each raw material to a belt conveyor so that the final mix consists of a properly proportioned burden. This conveyor delivers into another standard steel bucket elevator which, in turn, feeds to an 18-in. rubber burden feed conveyor.

The burden conveyor has a speed of 150 ft. per min., a capacity of 45 tons per hr., and is powered by a 15-hp. motor. It delivers the mixed burden to the steel furnace stock bins. Each of these feeds the furnace automatically to maintain a uniform charge; the rate of feed depends on the electric current characteristics of the furnace reaction zone.

Carbon electrodes are hoisted to the furnace floor and into position by a crane. Their positions in the furnace are automatically adjusted almost constantly by a system of electric switches and winches. Each electrode has a diameter of 35 in., weighs about 3 tons.

Materials handling in the packaging operations is limited to the casting, handling and packing of solid phosphorus wedges or cones and to the conveying and handling of steel drums by the usual methods. The drums have a total gross weight of 480 lb. Phosphorus is always shipped under water.

Heat Transfer—This is a relative minor operation. Coke is dried in a 5x40-ft. rotary dryer heated by an oil burner. It has a plain steel shell and a fire-brick burner chamber. Initial moisture of the coke is variable;

final moisture is under 1.0 percent.

Heat transfer in the phosphorus furnace is tied in with operating conditions and is a part of the reduction process. The outer steel shell of the furnace has allowances for expansion and contraction; it is cooled by a small stream of water.

Separation—The major separation operation is the electrostatic precipitation of dust from the phosphorus vapors and other furnace gases (see "Unit Process"). The unit is a Research Corp. two-pass hot gas unit with 48 tubes per pass. It handles 4,000 cfm. of gases at 650 deg. F.

Gases, fumes and dust from the furnace enter the precipitator at about 650 deg. F., leave at 450 deg. F., largely as CO and phosphorus vapors. The precipitated dust (with about 20 percent P_2O_5 content) is extremely fine—at least 90 percent of 2 microns or less in size. The precipitator removes 99.9 percent of all suspended matter from the gas stream.

Precipitated dust is collected in a receiver with inverted bell air locks and counterweights. It is sent by a screw conveyor to a steel dust conditioner where it is sprayed lightly with water. It is sold as a fertilizer ingredient because of its P_2O_5 and K values.

The other separation operation happens to be the next step in the process—removing the phosphorus vapors from the CO.

This condenser is a steel, unpacked tower some 40 ft. high and 5-9 ft. in diameter. The gas stream (about 25 percent phosphorus vapors and 75 percent CO by weight) enters near the top of the tower at 450 deg. F. It is sprayed with water at several levels as it travels down; this condenses the phosphorus vapors.

The phosphorus-water mixture leaves the bottom of the tower at about 130 deg. F. (well above phosphorus' melting point of 111.5 deg. F.). The mixture flows to the sump pit where the phosphorus settles out. From here it is pumped to storage.

Condensing water in the sump pits is pumped back to the condenser. It is recirculated until build-up of hydrofluoric and hydrofluosilicic acids makes it necessary to neutralize with soda ash solution, bleed off and add fresh make-up water.

Scrubbed CO, still with a small amount of phosphorus, leaves near the bottom of the tower at 130 deg. F. It is sent through Nash rotating liquid piston pumps and then to separators where the sudden drop in velocity separates gases from this remaining phosphorus—about 2 percent of the plant's entire output. The CO, now

practically free of P_2 , passes through a 14-in. main and is burned in the flambeau. (V-C has several ideas about how to make use of this CO; one of these is now in the engineering phases of development.)

Fluids Handling—Three fluids—cooling water, "phossy water" and liquid phosphorus—are handled in V-C's plant. None causes any trouble if common-sense engineering is used.

"Phossy water" is the operators' name for water with phosphorus in it. It may (and often does) contain small amounts of phosphoric, hydrofluosilicic and other acids.

Makeup water for cooling, scrubbing and other operations amounts to about 3,000 gal. for each ton of phosphorus product; total water in circulation in the entire plant at any one time is close to 30,000 gal.

Most of the "phossy water" handling is in connection with operating the phosphorus condenser. Water from the phosphorus sump pit is pumped by 300-gpm., 15-hp. submerged bilge pumps with vertical shafts of stainless steel. The pump case and impeller are bronze. The condenser water is handled at a temperature of 125-135 deg. F. The water line itself is of red brass to resist the slight acidity from accumulated H_2SiF_6 .

The same type of pumps are used for handling liquid phosphorus from the sump pit. The pit itself is made of concrete and acidproof brick. It has a small coil that can be used for cooling water or for steam.

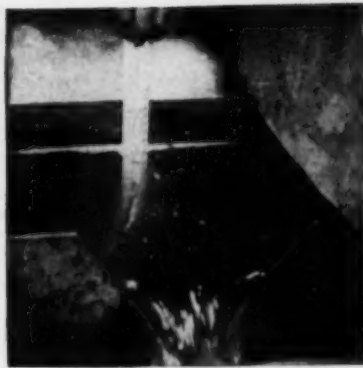
Liquid phosphorus is pumped from the sump pit, through a steel metering tank, then into the 100-ton steel storage tanks. Or it can be sent to a smaller storage that feeds the mold tanks. Here it is solidified with cold water and packed into steel drums. Most of the product, though, is shipped in 50-ton insulated steel tank cars. These are filled with liquid phosphorus, which is "frozen" before shipment.

Phosphorus is always stored, handled and shipped under water. For practical purposes the handling of "phossy water" and liquid phosphorus are one and the same operation. When a storage tank, for instance, is filled, phosphorus replaces the water; when it is emptied, water replaces the phosphorus.

Water is also the key to safety in a phosphorus plant. As long as there's plenty of water everywhere—and V-C sees to it that there is—there's no danger from fires or burns. Emergency showers are everywhere. They've never been used!



CONCENTRATED SLUDGE: Tiny air bubbles float the solids, which are then collected and discharged by rotating blades.



CLEAR EFFLUENT: Ruler, not its reflection, shows beneath the surface.

Diffused Air Floats Particles For Waste Disposal

A simple method of dispersing innumerable tiny air bubbles in waste effluents is making it possible to recover difficult-to-settle solids and immiscible liquids for pollution control.

ALLEN I. BARRY

Water pollution from industrial wastes has reached a point in many areas of the United States where further increases cannot be tolerated. Fortunately, a new method has been developed for removing suspended solids from plant effluents by flotation with infinitesimally small air bubbles. Although not a panacea for all industrial wastes, the new method has produced economical and efficient results on many different problems. Among these are full-scale installations on soap wastes, paper mill white water, and oil in oil-refinery effluent waters. Pilot plant tests have shown success on board mill and toilet tissue mill wastes, glue plant and commercial laundry wastes.

As the pollution problem has become more severe, industry has spent large sums in development of waste treatment processes, often without success. Consequently, new processes tend to meet with skepticism. When suspended particles are to be dealt with, the usual approach is to try to settle them, but the sludge formed in

many cases is thin and difficult to dispose of, or recover. Changes in temperature, rates of flow, concentration and other variables often upset the operation and prevent a successful solution. A somewhat obvious approach is to float the solids (if they cannot be settled) by the attachment of air or gas bubbles to the individual or agglomerated particles, thus buoying them up in a body of fairly quiescent liquid. The idea appears simple, but extensive experimental work was required before the suitable methods and apparatus could be developed.

One method of bubble attachment that has been tried with limited success is to release dissolved air from the water by reducing the pressure. Successful bubble flotation depends on the availability of any desired quantity of bubbles with maximum diameters of 0.001 in. or less. To give adequate time for flotation it is necessary to be able to release great numbers of bubbles continuously into the water, without disturbing its normal quiescence.

These aims were achieved in the unit developed by engineers of F. S. Gibbs, Inc., but only after many failures with the usual methods of dispersing bubbles in liquid. A simple

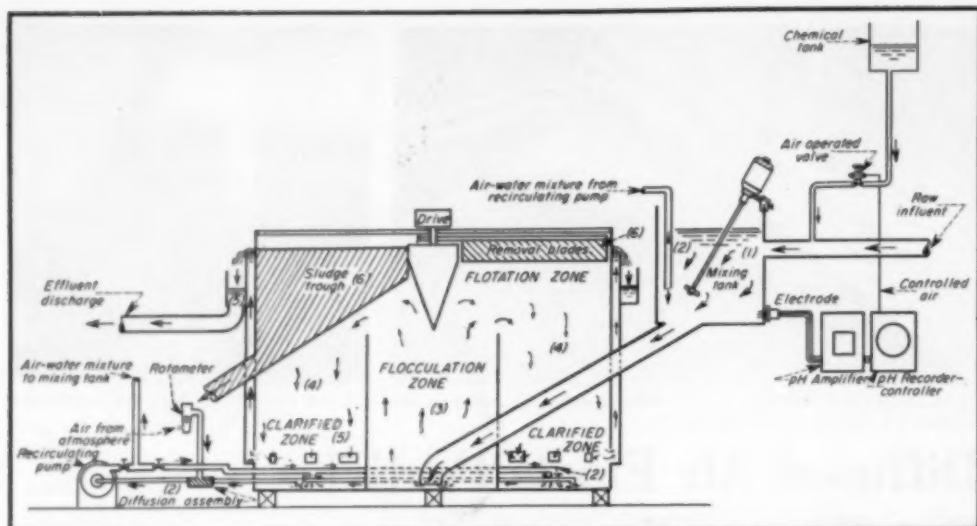
"diffusion assembly" placed at the inlet of a recirculating pump was finally developed, after recognition of the relations between surface tension and bubble size. This gave the clue, although there were still many problems to solve before the bubbles so produced could be used effectively.

The final result was the completion of a flotation unit which is practical and reliable and requires a minimum of operating labor and maintenance. It requires no more supervision than that needed for its electric pumps and automatic control equipment. Routine manual labor is eliminated. The diffusion assembly cannot plug, and will foul only over a long period of time, if it fouls at all. The unit can handle comparatively high flow rates, normally around 3 gpm. per sq. ft. of tank area, and up to 6 gpm. with excellent removals in some cases. Recovered sludges have varied from as low as 2 percent dry solids to as high as 90 percent in a liquid fat separation process. Naturally, results depend on the loading and character of the suspended material.

HOW UNIT WORKS

As now constructed the unit is shown in the accompanying flow dia-

ALLEN I. BARRY is a chemical engineer, with F. S. Gibbs, Inc., Boston, Mass. He has recently been conducting some of the tests described here.



FLOW DIAGRAM: In six steps of chemical treatment, aeration, flocculation, flotation, effluent overflow, and solids collection the Gibbs unit recovers difficult-to-settle solids and immiscible liquids from waste liquors.

gram. This design is the culmination of several pilot plants, two full-scale installations and numerous tests on a variety of wastes. Its parts carry out six necessary steps of: (1) chemical treatment, (2) introduction of bubbles, (3) flocculation, (4) flotation of solids and downflow of clear liquid, (5) clarified liquid overflow, and (6) removal and discharge of floated solids. The numbers locate the corresponding points on the diagram.

1. If needed to coagulate or flocculate the fine suspended particles, chemical treatment is provided under pH control in an external mixing tank.

2. Clarified water containing innumerable small air bubbles is mixed with the treated influent near the entrance of the unit and before flocculation takes place. Additional bubble-containing water is injected in the flotation zone (4). The production of the innumerable small-size bubbles is achieved by recirculating clarified water from a suction header in the bottom of the flotation zone, through the diffusion assembly located at the inlet of the centrifugal recirculating pump. This device serves to inspi-rate and mix a small quantity of air into the recirculating water. The air is distributed uniformly in the stream in extremely fine bubbles, less than 0.001 in. in diameter. The air requirements are not critical although they do vary considerably with the character of the waste. In typical cases air needed might range from about 10 to 40 cc. per gal. of throughput per min.

Part of the bubble-containing water enters the flotation zone through a header placed above the recirculation draw-off header, the remainder being mixed intimately with the incoming treated water before it enters the flocculating chamber. Since the clarified water contains a part of the treating chemicals used for flocculation, its recirculation serves to reduce chemical requirements.

3. Incoming treated water enters a central flocculation chamber at the bottom, flowing upward for a few minutes while flocculation takes place. This chamber is well below the liquid surface of the unit. The water discharges near the top into the flotation zone. Most of the flocculated particles, with numerous air bubbles attached, rise rapidly to the surface.

4. In the flotation zone water flows downward to a point near the bottom of the unit. The water which enters the flotation zone has been stripped of most of its suspended solids. Those solids that remain in suspension are carried downward where they meet a rising flow of the small-size bubbles. Vessel depth is determined so as to distribute these bubbles efficiently throughout the entire area of the unit. The bubbles attach themselves to the particles and thus strip the waste of virtually all suspensions. In typical cases, 10-20 ppm. remain in the effluent.

5. Discharge of the clarified water takes place through slots near the bottom of the tank, in the outer wall of

the flotation zone. The clarified water flows up a narrow annular passage and then over an adjustable weir into a discharge channel. The adjustable weir controls the liquid surface level of the unit and requires adjustment only when the unit is installed.

6. Suspended particles which are buoyed to the surface by the attachment of the bubbles concentrate on the surface and form a stable, floating sludge blanket. Slowly rotating blades concentrate the sludge and squeeze it over a slightly inclined removal plate that is radially located in the tank. From the plate the sludge drops into a trough and then flows into a holding tank.

The solids content of the sludge removed varies widely, depending on the character of the suspensions being removed. For example, when operating on a waste white water from toilet tissue manufacturing, the sludge consistency may be as low as 2 percent dry solids. When operating on rendered and unrendered fats carried in a hot waste water, the percent of fat in the floated material may average above 90 percent. Among the factors influencing sludge consistency for a specific operation are: (1) speed of rotation of the removal blades, (2) liquid level in the unit, (3) air volume, and (4) variations in suspension concentration.

PILOT PLANT TESTS

Development of the Gibbs unit has come about as the result of operating

several pilot plants with capacities up to 100 gpm. These have been installed on the actual waste-producing operations so the problems of chemical application and control, equipment development, sludge disposal or re-use, and analytical methods have been based on actual operating experiences on specific waste problems. In general, the problems have been difficult ones. Pilot plant equipment now in use provides the necessary auxiliaries for a thorough study and includes duplicate automatic pH recording and control instrumentation, chemical feeders, mixers, and equipment for measuring air and effluent flow, and for automatic sludge removal. Sludge filtration equipment can be added if needed. Results achieved on several recent pilot plant tests will be of interest.

Paper Board Mill Wastes—Pilot plant tests, followed by a full-scale installation now being completed on paper mill white water at Fitchburg, Mass., interested officials of the Downingtown Paper Co., of Downingtown, Pa. They doubted, however that equally good result could be obtained on their waste which is a board mill combined waste containing 5-6 lb. of solids per 1,000 gal. This concern was already operating a sludge-blanket, upflow type waste water clarifier which gave removal efficiencies of only about 80 percent (1 lb. solids per 1,000 gal. influent), at maximum flow rates of less than 1 gpm. per sq. ft. of unit area. Recovered sludge averaged 0.5 percent dry solids consistency.

Installed at Downingtown, the Gibbs pilot unit undertook the treatment of the continuous waste water flow from two paper board machines. This was considered more difficult than

the combined wastes of the entire plant. Initial studies with alum, and with alum and caustic soda for coagulation, gave fair to medium results with high chemical consumption. Then, it was found that alum and activated silica* would give superior results with economical chemical consumption.

The pilot unit was operated for a one month period, utilizing alum and activated silica under the normal varying conditions of wastes flow. In addition, deliberate efforts were made to upset operation by inducing wide and rapid flow rate changes and by dumping in shock loads of carbon black, titanium oxide, and beater stock. Average removal efficiencies, despite the particularly difficult operating conditions, were above 95 percent. The effluent contained less than 0.3 lb. per 1,000 gal. and average sludge consistency was 3.0 percent dry solids. These efficiencies were maintained with flow rate variations from 1 to 6 gpm. per sq. ft. of unit area.

Temperature of the influent varied between 75 and 90 deg. F., with a few runs made at 60 deg. At the lower temperatures, it is believed that the floc forms more slowly, preventing rates greater than 5 gpm. per sq. ft. from being achieved. However, conclusive data were not obtained.

Toilet Tissue Wastes—At the mill of an eastern paper maker the effluent from the tissue machines contains

* Activated silica, as described by Merrill and Bolton in *Chem. Eng. Progress*, Jan. 1947, is made by partially or completely neutralizing the alkali of a dilute sodium silicate solution to initiate the formation of silica micelles, and finally diluting to stop further increase in size. This leads to formation of a gel which is useful in coagulation processes where a highly charged, readily adsorbed, negative lyophilic colloid is needed.

Operating Results on Toilet Tissue Waste

(Runs made for 1-1 hr. after which conditions were changed. Inf. = influent, Eff. = effluent, s.s. = suspended solids)

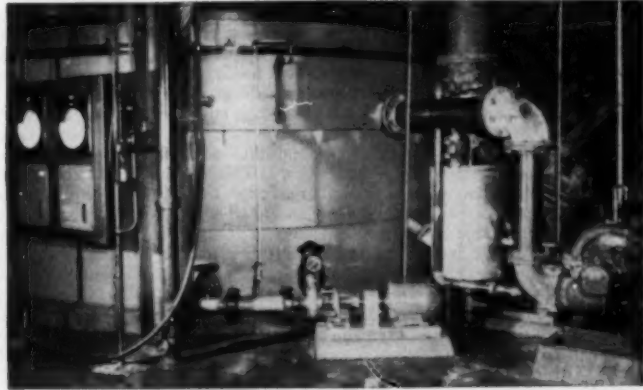
Run No.	1	2	3	4
Flow, gpm.	55	55	55	55
Inf. s.s., ppm.	190	184	193	192
Inf. pH	6.8	6.8	6.8	6.8
Inf. temp., °F.	90	90	79	78
Chemical No. 1	Alum	Alum	Alum	Alum
Grains/gal.	4.0	4.0	3.0	2.0
pH	4.0	4.7	4.8	5.1
Chemical No. 2	Silica	Silica	Silica	Silica
Grains/gal.	1.0	0.5	0.5	0.5
pH	4.0	4.8	4.9	5.7
Eff. pH	6.0	4.8	4.8	5.7
Eff. s.s., ppm.	1.3	8	10	13
Solids, percent	2.2	2.0	2.0	2.5

about 150 ppm. of suspended fibers. A waste with this small loading had not been studied on a Gibbs unit, so a pilot plant was operated for a short while at that plant. Several runs were made using papermakers alum and activated silica as flocculating chemicals. At the maximum flow rate available of 100 gpm. (over 6 gpm. per sq. ft.) a clear effluent was produced. Because of the character and the amount of fiber in the waste, the dry solids content of the recovered stock was only 2 percent when the removal blades were operated at their lowest setting. However, this concentration was satisfactory to the company officials for the planned re-use of the sludge. A summary of data from one day's operation at a rate of 3½ gpm. per sq. ft. of surface appears in the accompanying table.

Glue Wastes—Pilot plant work on the waste waters from a glue plant has demonstrated that grease and other suspensions can be flocculated with a ferric salt and a clear effluent obtained with the unit. The consistency of the sludge produced was approximately 12 percent and could readily be concentrated to 25 percent on a vacuum filter without filter aids or additional chemical application. We



PILOT PLANT operating on board machine waste water at Downingtown Paper.



FULL SCALE 14½ x 9-ft. Bird-Gibbs unit for white water recovery now being placed in operation at Fitchburg Paper Co.

feel that the grease recovered in the sludge would pay a major portion of the chemical costs required.

Laundry Waste—Waters discharged by commercial laundries contain grease, soap, alkalis, bleach, starch, and filth of every conceivable sort. The purification of such waste waters presents many problems that are difficult to solve. However, a pilot plant unit was operated on commercial laundry wastes with excellent results.

FULL SCALE PLANTS

White Water—Reference has been made to the pilot plant study at the Fitchburg Paper Co., Fitchburg, Mass. As a result of this study a full scale unit is now being placed in operation by Bird Machine Co., which handles installations of the Gibbs unit in the paper industry. This unit is to clarify the white water discharged from one of the fourdrinier machines. It is fabricated of stainless steel and is 144 ft. in diameter and less than 9 ft. high. The unit, shown in one of the accompanying views, is in the basement under the paper machine. The white water contains from 2,000 to over 9,000 ppm. of suspended solids, at flow rates up to a maximum of 700 gpm. Automatic pH control of chemical application is used. The recovered stock is to be returned directly to the machine furnish. On this waste, the pilot plant unit showed better than 99 percent recovery (effluent containing 0.1-0.2 lb. solids per 1,000 gal.), at 4 gpm. per sq. ft., with influent loadings averaging 16-18 lb. per 1,000 gal. Sludge consistencies averaged over 5 percent dry solids.

Fatty Acids and Soap—In the manufacture of soap and the refining and processing of edible oils, water from the barometric condensers discharges to waste or over cooling towers. The first full-scale installation of a Gibbs unit was made at the Procter and Gamble factory in Quincy, Mass. It has been in successful operation since Aug. 9, 1949. This unit receives the waste waters from the barometric condenser hot wells. Emulsified fatty acids are converted to insoluble soap with the chemical application controlled by automatic pH equipment. The insoluble soap particles form a sludge blanket on the surface of the unit and this sludge is removed to a holding tank from which it is pumped back periodically to the soap plant for acidulation and recovery. The effluent is discharged directly to the bay, with less than 10 ppm. of undissolved fatty acid. This completely eliminates the pollution problem.

A 1,500 gpm. Gibbs unit is now being erected at the Archer-Daniels-

Estimating Requirements for

PRELIMINARY cost estimates require a rough approximation of the amount of electricity, steam, and water which will be consumed in a proposed new plant. Except in unusual cases, utilities costs contribute to the price structure of chemical commodities to only a modest degree. Even in the case of electrochemicals, the cost of power averages only about 20 percent of the selling price, and this is about the extreme for chemicals. For pre-design estimates, therefore, educated guesses as to consumption of utilities are generally acceptable. Calculation of actual motor sizes, thermal efficiency of dryers, cooling water temperature rise, and similar details can be postponed until the project begins to take firm shape.

The charts on the opposite page, covering process steam and water re-

quirements for a number of various chemicals, as well as last month's chart on power requirements, are designed to assist the process engineer in estimating his utility consumption for a proposed project without having to go into all the minor details.

Figures for steam exclude that used primarily for mechanical drives and power generation. Water consumption is generally based on once-through usage, unless reuse is inherent in the process. Some of the data were obtained from the published literature; cooperating engineers in various industries supplied other previously unpublished information. No claim is made for accuracy; available figures for any given commodity were found to vary over as much as a two-fold range. Data were selected and averaged, however, with some degree of judgment.

Midland plant in Decatur, Ill. This unit is to remove fatty material from discharge waters from the deodorizing condensers. The recovered fats will be returned to process, while the effluent will be discharged to Lake Decatur pending erection of a cooling tower return system.

Petroleum Oil Refining Waste—The waste waters from oil refining operations contain quantities of oil which are not removed by API separators. The John I. Ray Oil Co., South Braintree, Mass., discharged waste waters from reprocessing operations into a collecting sump, from which the flow went through two API separators in series, discharging finally into a sewer. Oil which got by the secondary API separator resulted in drastic action by the local authorities who finally closed the sewer. This action shut down the plant.

Gibbs engineers adapted an existing storage tank as a flotation tank and installed a Gibbs gas diffusion system. The flotation tank receives the discharge from the collecting sump and discharges directly to the first API separator. It would have been preferable to take the discharge from the separators into the flotation tank but this was impossible. Nevertheless, the results achieved in tests were sufficiently good to induce the authorities to reopen the sewer and allow the company to resume operations.

Before restarting the plant it was felt that there was a possibility of floating some of the clays along with

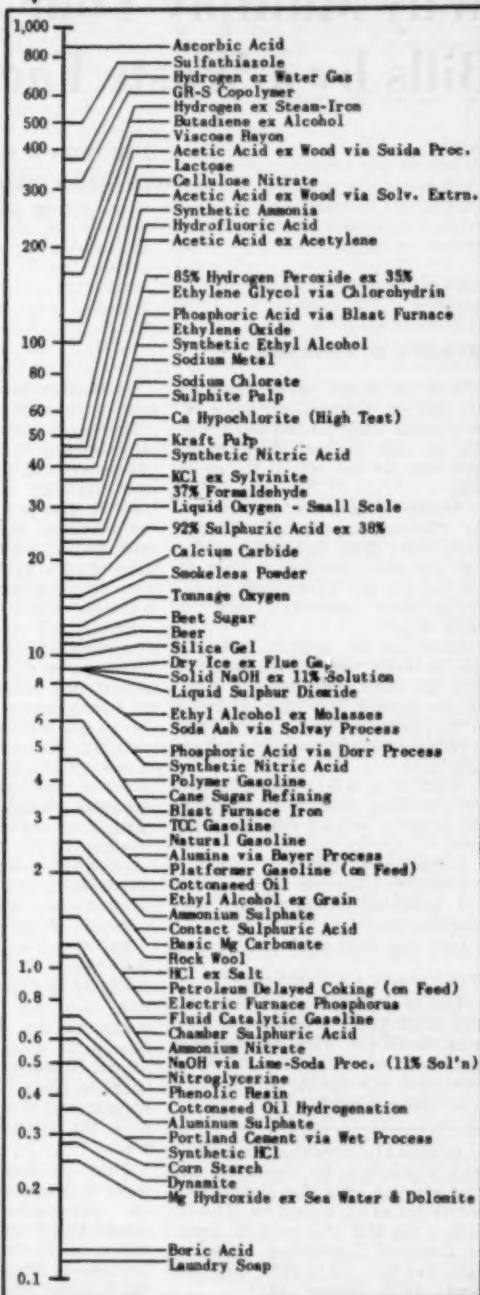
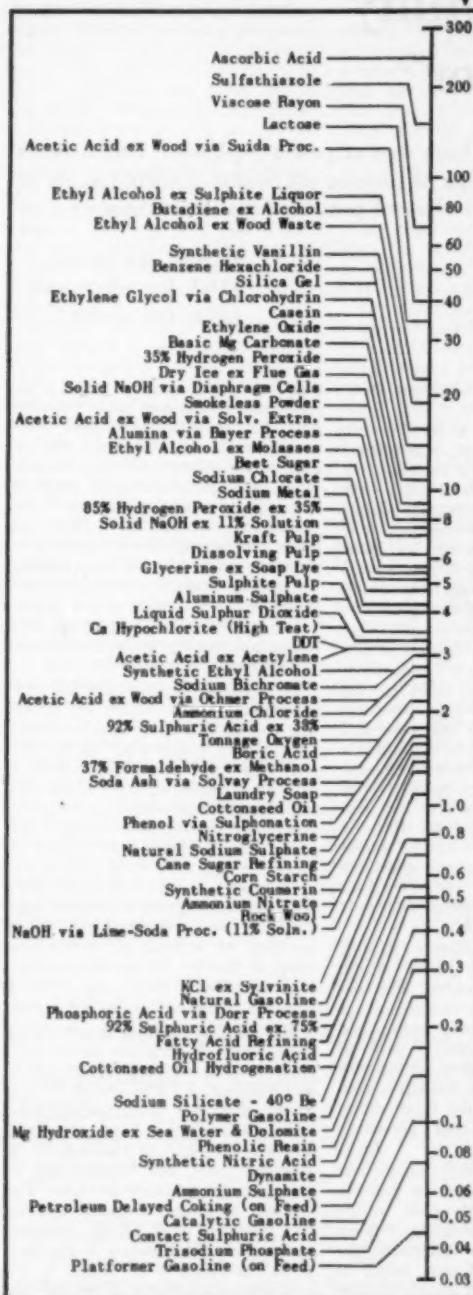
the oils. This concern was eliminated when the plant started up. With no chemical treatment, the physical action of the air seems to scour the oil from the clay particles and other suspensions. Oil particles move to the surface for simple gravity removal. The API separators do collect some sludge but this sludge is practically free from oil. The waste waters discharging from the flotation tank carry suspended material but there is no evidence of oil carrying through with the water. Oil in the waste water ahead of the flotation unit varies from a minimum content of 40 to 50 ppm. to a maximum in excess of 90 percent, which may be caused by emergency or accidental dumping of oil into the plant sewers. Nevertheless, recovery efficiency holds constant over this wide range of oil concentration in the influent.

In addition to its application in waste treatment, we believe that the diffusion assembly used to provide the air bubbles in the Gibbs unit has a wide field of potential application in processes which depend on the excellence of their diffusion or dispersion of air or gases into liquids. Preliminary tests on gas absorption, fermentation and the carbonation of beverages have given results that warrant full exploration, and indicate superiority to other known methods. Uses such as these, in gas dispersion and diffusion, may eventually outweigh the use in waste treatment for which the device was originally developed.

Process Steam and Process Water

Steam, pounds per pound of product

Water, gallons per pound of product



Why Multiply Your Utility Bills by a Waste Factor?

You can cut the high cost of power—plenty. But it takes more than a campaign of turning off lights. Cutting waste in one plant showed potential yearly savings of . . .

. . . \$1,908 for steam.
. . . \$564 for electricity.
. . . \$216 for water.

JACKSON D. LEONARD

"Sure we believe utility conservation pays off. Catch a guy going off for a smoke while his machine's running idle and 'Big Joe,' the foreman, reads him the riot act till the air is blue."

"Utility conservation? Nuts! Let the efficiency experts and the old maids worry about such penny-pinching. We make the best product in the business, and a handsome profit. We're more important things to worry about."

These are the opposite poles of opinion from two plant managers. Both are scientifically trained, scientifically minded. But their reasoning in this instance is about as scientific as catching birds by sprinkling salt on their tails.

What, then, is the scientific method for controlling power costs? Roughly, our proposed program falls into three parts:

1. Budgetary Control
2. Utility Incentives
3. Individual studies of major consumption points.

Let's take them one at a time:

STEP 1—MAKE A BALANCE SHEET

This is easy. You simply find out how much power a segment of your plant should use. Then find out how much you are using. If you're using more than you should, the next step is to find out why?

JACKSON D. LEONARD is a consultant with a penchant for developing the cost reducing ideas that management always has an ear cocked for. This article is the fifth of a series to appear in *Chemical Engineering*. Dates of the other four: Oct., 1949; Aug. and Sept., 1950; January, 1951.

To illustrate here's what one plant manager found out.

His plant consisted of six different manufacturing buildings, plus offices, powerhouse, and service buildings. It used electricity which it purchased from the local power company, steam, compressed air, and vacuum which it generated in its own power plant, pure water which it purchased from a local water company, and creek water which it pumped from a neighboring stream.

At the end of each month, that month's consumption of each utility (as shown on the power house main meters) was arbitrarily split to the six manufacturing buildings based on the pounds of product that each had produced. Fluctuations in the amounts of each utility consumed were charged to hot or cold weather, good or poor operation, breakdowns, and the like. Actually, no one really knew what the consumption of each utility should be, or whether the reasons given for the fluctuations were correct or not. In most cases, the reasons were only a fraction of the truth.

The plant cost sheets showed three major expense items: steam, electricity, and pure water. The first step, then, was the installation of meters on the electric, steam, and pure water mains entering each of the six buildings. These meters now served to break down the utility consumptions to the actual users, rather than the arbitrary split previously used.

Next, an engineering survey was made to determine what the theoretical consumption of each utility should be for each building. For example, in the case of electricity, the horsepower rating of each motor in the building plus the length of time

that each had to operate to meet process requirements was used to determine the theoretical, or "goal" consumption. Steam and water were a little more time-consuming because rough calculations had to be made at each process point to determine these theoretical consumptions. Most of these determinations were fairly simple since nothing more than heating or cooling was involved. Arbitrary standards were used at a few points where multiple effect evaporators, and falling film coolers made the calculations difficult or impossible.

Once having established actual consumptions of each utility by metering, and theoretical or goal consumptions by an engineering survey, the next step involved the issuance of a daily report showing these actual and goal figures for each building, the deviations, and the potential savings if the actual consumptions are brought in line with the theoretical. These reports were issued each morning after the meter readings were obtained from a quick round of the plant. Each member of supervision received a copy, so that by mid-morning, corrective steps were under way. Fig. 1 shows a typical utility budget report.

Examination of this report shows three cases of deviation under electricity which merited investigation. In Building 1, the deviation was found to be due to an operator who failed to turn off a large pump and wet grinding mill at the end of its specified cycle, but instead had allowed it to continue to run. The building supervisor reviewed the correct procedure with all the operators on this one. In Building 3, the deviation was found to be caused by the complete reprocessing of several sub-

standard batches of material. Thus, a goodly portion of the production from that building had had two expenditures of utilities put upon it. A check by the building supervisor revealed that an obsolete processing procedure was being used on one shift, accounting for the substandard batches. The correct procedure was passed on to this group. In Building 5, the deviation was found to be due to the grinding of special test batches of material for research trials, and therefore represented a justifiable deviation. In the same manner, steam deviations in Buildings 1, 2, and 4, and pure water deviations in Buildings 1, 2, and 3 were also investigated, and corrective steps taken by building supervisors.

In this way utility consumptions were brought under control with a simple budgetary system. However, this is only the first step. The second step is to level off consumption peaks. Few realize that most power costs are based both on demand and consumption. Electricity cost, for example, at 1 c. per kwh. is composed of about $\frac{1}{2}$ c. for peak demand charges, and about $\frac{1}{2}$ c. for the electricity actually used if the demand and consumption are well balanced. However, if peak demand is high in relation to normal consumption, then the electrical cost might run as high as $\frac{3}{4}$ or $\frac{1}{2}$ c. per kwh. for demand charges plus the $\frac{1}{2}$ c. for usage. Therefore, if peak demands can be reduced or leveled off, the cost of the demand load will be correspondingly reduced.

In one plant where a complete utility study was made, peak demand load was reduced by 40 percent by re-scheduling certain part-time operations from the day shift to the night shifts. This re-scheduling of operations not only reduced the peak daytime electric load, but also relieved traffic congestion in certain plant areas, and relief of the congestion improved operating performance in those areas.

On another plant, the peak load demands for cooling water necessi-

tated the operation of three (30 h.p.) pumps continuously, and a fourth, standby pump, occasionally. The utility survey showed that the normal average consumption only equalled the output of $1\frac{1}{2}$ pumps. The resulting investigation showed that in a certain process building, process cycles had been set up so that batteries of large evaporators and condensers were operated through their batch cycles simultaneously. When these batteries were broken down into units, and scheduled so that the individual units were in various stages of their cycles at any given time, then peak demand from this operation was levelled out so that this single change enabled shutting down one pump completely.

The third step in this budgetary program is to make individual studies on high consumer points which have been brought to light by the utility survey required to set up the budget. These studies can often reveal very poor efficiencies in individual pieces of equipment, and corrective measures sometimes consist of nothing more than changes in the operating procedure, or minor equipment modifications. For example, in a certain plant, the process required that large batch tanks be used to bring process slurry up to the boiling point, and hold it there for 6 hr. to accomplish a desired change in the material. Steam consumption at this point was extremely high. A theoretical calculation showed that the amount of steam that should have been used to accomplish this processing was about a third of the amount actually being used. Investigation of the operation showed that in order to keep steam from the boiling slurry from escaping into the building, large stacks had been provided on the tank tops. Thus, when the slurry reached the boiling point, very little steam should have been used to maintain it at this temperature. Actually, due to the draft stacks on the vessels, the steam consumption remained high because the heat input was being lost out the draft

stack. An expenditure of a few dollars to install dampers in these draft stacks permitted cutting the draft down so that no steam escaped from the tank into the building, and little was lost out the stack to the outside. The resulting savings amounted to thousands of dollars per year.

STEP II—GETTING THE WORKER INTERESTED

Once having established normal consumption patterns and the use of budgetary control to get consumptions in line, we can either let the program remain at this level, or elect to move on to the latest development—utility incentives.

Where budgetary control depends on alert supervision, and a constant policing action, utility incentives shift the burden to the operators, and even where budgetary control has obtained normal consumptions, incentives can effect further reductions. Actual experience indicates that budgetary control can reduce utility costs by as much as 25 percent, but utility incentives can then be applied to gain an additional 10 to 15 percent reduction.

The answer to how incentives can effect reductions below our normal consumption pattern can best be explained by saying that budgetary control detects and corrects the large wastage of utilities, while the operators, having the stimulus of utility incentives, can detect and correct a multitude of small wastes.

The actual details of establishing utility incentives depends on whether it will become a part of an existing incentive system, or be established separately. A number of methods can be used, but rather than attempt to outline them in this article, the best recommendation that can be made is to consult a firm or individual with experience in this field before attempting to set up an incentive plan.

STEP III—GET YOUR IDEA MEN WORKING AGAINST WASTE

Very effective economies can sometimes be effected by individual studies of utilities not covered on our budgetary control, or utility incentive plans. For example, a plant that consumed nitrogen gas by the trailer truck load, and had a monthly nitrogen cost of several thousand dollars, installed a Kemp Gas generator which supplied them with the same amount of nitrogen, and of equal quality, but at less than $\frac{1}{4}$ the previous cost.

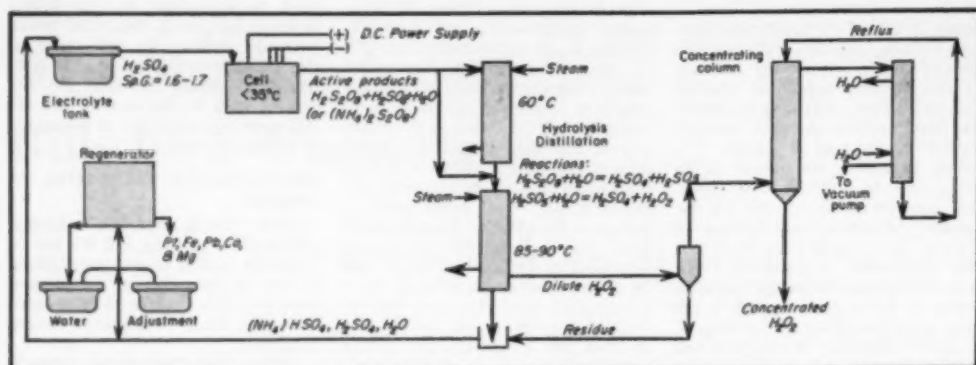
In another plant, a half dozen separate brine cooling systems were used to service separate operations. These

Fig. 1. Typical utility budget report from the plant studied.

	Bldg. 1	Bldg. 2	Bldg. 3	Bldg. 4	Bldg. 5	Bldg. 6
I. Actual KW Consumption.....	2,700	1,500	4,000	2,300	4,300	3,600
Goal Consumption.....	2,000	1,200	3,500	2,300	2,500	3,000
Deviation.....	700	300	1,100	200	1,800	600
Potential Savings.....	\$7	\$3	\$11	\$3	\$18	\$6
II. Actual Steam Consumption, thousands of pounds.....	168	240	13	110	60	22
Goal Consumption.....	120	108	11.5	85	50	18
Deviation.....	48	72	0.5	25	10	4
Potential Savings.....	\$48	\$72	.....	\$25	\$10	\$4
III. Actual pure water consumption, thousands of gallons.....	65	175	41	5	5	24
Goal consumption.....	32	75	30	3.5	4.9	20
Deviation.....	13	100*	6	0.5	0.1	4
Potential Savings.....	\$2	\$18	\$1	.....	.....	.....

*Wide deviation due to installation of only part of the new lines required to convert from pure to creek water. Goal figure is based on consumption of pure water after conversion of primary coolers to creek water use.

(Continued on page 116)



PROCESS shows steps in transforming H_2O to H_2O_2 and concentrating it for industrial uses.

Hydrogen Peroxide

Chemical engineering and electrochemistry are combined in modern H_2O_2 plants. Here are some basic problems involved in building these units.

G. A. ZOTOS

Hydrogen peroxide is a neutral carrier of active oxygen. It leaves water and oxygen as the only products after decomposition. This enables us to use its oxidizing or reducing potential in a wide range of industrial applications. Exothermic decomposition also facilitates its use. An almost continuing scale for governing the desired effects can be secured through control of the concentration, temperature, pH value or even specialized catalysts.

Early predictions concerning the future of the electrochemical manufacturing processes have been accurate. Tremendous developments during the last ten years have made hydrogen peroxide available to industries in any desired concentration (up to 90 percent by weight) in the form of a pure and stable product. Advanced tanking methods have made transportation and storage possible on a large scale.

New applications and techniques are gaining in importance as our theoretical knowledge of this compound improves. Manufacturing costs are today the biggest restriction on its application as a competitor with other oxidizing or bleaching agents.

G. A. Zotos has worked on H_2O_2 for many years both in Germany and the United States. He is now a consulting process engineer.

During the past few years American industries have made great progress in the manufacture and commercial applications of H_2O_2 . Before the war German industries played an important role in the development phase of the basic electrolytic techniques used in the manufacture of hydrogen peroxide.

Compared with the information on chemical engineering techniques employed in the production of most chemicals there is very little information available concerning the technology employed in the production of H_2O_2 .

Considerable quantities of the peroxide are now manufactured electrolytically. In fact, electrolytic anodic methods have been brought to a degree of perfection where no basic improvements in production costs may be expected.

However, efforts are being continued to develop new methods of manufacture on a synthetic basis. These techniques require a high skill in advanced thermodynamics and diversified experience in design.

In any electrolytic process the capture of the active oxygen is produced by anodic oxidation of the SO_4^{2-} radicals. These are being made available in solution in the electrolyte from H_2SO_4 or alkali sulphates. Ammonium sulphate is the most suitable from the

electrolytic angle, while potassium persulphate has particular advantages as an intermediate compound for the hydrolysis to hydrogen peroxide. Pure sulphuric acid is still used as a carrier of the active oxygen via oxidation into persulphuric acid. Ammonium sulphate in considerable concentration is the electrolyte in many plants.

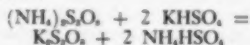
Among the main manufacturers in this country, Buffalo Electrochemical Co. uses the potassium conversion process extensively. E. I. du Pont de Nemours & Co. along with Pennsylvania Salt Mfg. Co. use electrolytic techniques based on the straight liquid process. The potassium persulphate process is similar in concept to the classical prewar pattern but has been substantially improved. In all processes used today the useful ingredient which yields the hydrogen peroxide is the per-radical $S_2O_8^{2-}$.

The straight liquid process consists essentially of a closed system between electrolytic and hydrolyzing plants with no interruption other than some auxiliary by-pass circuits depending on the type of electrolyte used. The accompanying flowsheet shows the basic pattern. It is characterized by the use of a true solution in almost all of the parts of the circuit and can be operated with pure sulphuric acid or solution containing ammonium sulphate or other secondary auxiliaries.

The pure acid process has the lowest current efficiency in the electrolysis. Current efficiency reaches about 70-75 percent, while the concentration of persulphuric acid seldom exceeds 35 to 38 percent. It has some advantages in that crystallization trouble within the system is eliminated. Another advantage is complete regeneration by distillation of the concentrated electrolyte in fused silica equipment.

Better current efficiencies are obtained through using mixtures of ammonium sulphate and sulphuric acid. They easily exceed 80 percent and cooling conditions are less extreme. The lower solubility of the resulting $(\text{NH}_4)_2\text{S}_2\text{O}_8$ imposes limits of allowable saturation in active oxygen at the end of the electrolysis. Too high an active oxygen content causes crystal formation. This is harmful in view of the dangers of obstruction to flow through the cell. Crystals impose problems in cell design.

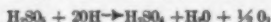
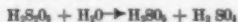
In the conversion process the final concentration in the electrolysis is not important because after the double reaction:



the precipitated potassium persalt transports the active oxygen in a solid state.

CELL THEORY

In the course of process development, considerable experience has been gained concerning the mechanism of electrolysis and its practical applications. Percompound cells for the anodic oxidation of persulphate require an electrolytic plant based upon the exclusive use of platinum metal for the anode. In addition to the typical industrial requirements for a good cell there are three specific requirements influencing the H_2O_2 operation. They are: (1) The initial investment for platinum metal, (2) platinum consumption rate, (3) means for suppression of the secondary depolarizing reaction by Caro's acid (H_2SO_5):



These equations are a simplified over-all version of a series of reversible and non-reversible reactions along or near the platinum surface. High initial acidity promotes the retrograde reaction and high current concentration rates per electrolyte volume restrain the formation of Caro's acid.

By means of increasing the oxygen discharge overvoltage a better current efficiency is secured. This re-

quires more amperes per surface unit of anode despite the over-all increase in voltage. To meet both conditions designers generally scatter the surface continuity of the platinum sheet, using either platinum strips or conveniently supported platinum studs as the active surface parts of the anode. Both methods are widely used. Each has its advantages and weaknesses.

Depending upon the cell conformation around the anodes, experience has shown that ampere rates ranging from 1.5 to 5 amp. per sq. cm. are convenient. Generally this will meet the requirements for overvoltage, low platinum investment and reasonable platinum consumption. However, the trend of higher platinum consumption is on the side of the higher current rate. Platinum consumption is an unavoidable but controllable phenomena, based on sensitizing of the metal to form reversible peroxides. This can be done by using the proper overvoltage, which is the sole active factor for the condensation for the per molecule in the electrolyte. Under these conditions anionic gas diffusion takes place at energy levels corresponding to a high pressure. Since the cycle is short timed there is some colloidal dispersion of metal by molecular erosion.

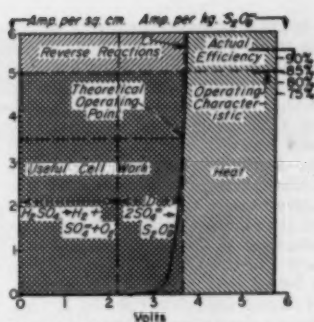
When processing with ammonium sulphate solution of low acidity as is usually the case in the conversion process, the cell design is considerably simplified because of the improvement of Caro's acid condition. Volume rate may be reduced and less cooling water is required.

It is less favorable in strong acid cells where diaphragms are used to advantage. Here cooling conditions are severe. Diaphragms separating the anolyte and catholyte streams permit useful combinations such as the injection of any remaining Caro acid or hydrogen peroxide in the back stream of liquids before introduction in the anodic side.

ENERGY IN CELL

The accompanying chart illustrates graphically the pattern of energy in areas within a persulphate cell. The chart shows the theoretical current supply for the production of 1 kg. of S_2O_8 versus the emf. in volts for operation. Therefore, the area is energy in kilowatts.

In addition to the voltage for decomposition (D on the chart), being almost constant within the considered limits, the oxygen-platinum overvoltage is an active factor. Under all conditions its value depends on the specific current density on the anode surface (C). Their algebraic summations represent the minimum theo-



CELL ENERGY repartition chart.

retical voltage for the S_2O_8 condensation. However, the voltage required in practice for keeping the operation under industrial production conditions is materially higher. It amounts to about 4.5 to 7 volts. Surplus energy is transformed into heat.

However, some current deficiency occurs by direct hydroxyl ion conversion into O_2 or O_3 or indirectly by the retrograde reaction. For certain average temperatures in the electrolyte and a certain initial composition there is a point at the intersection of the voltage and current efficiency parallel. However a group of such points defined experimentally, give the characteristic of the cell quality, over-all efficiency and the repartition of cell energy. This makes it possible to determine a voltage-energy curve for each condition.

General energy consumption does not necessarily coincide with the optimum output per unit nor the optimum economical operation of the plant. Therefore, the above approach permits a more positive indication of the operation for better control when it is used in connection with the usual analytical supervision. One of the weaknesses of normal cell design is failure to completely use the cathodic discharge. The collection and use of hydrogen produced is now possible in cell designs of considerably larger unit capacity. Since the gas purity exceeds 99 percent this is a very attractive improvement.

HYDROLYSIS TO H_2O_2

The general method for yielding hydrogen peroxide is the hydrolysis at temperatures ranging from 60-100 deg. C. Initial presence of sulphuric acid along with the persalt delivering the active oxygen is as essential as the presence of the proper amount of water. The fact that water vaporizes under all conditions faster than any produced hydrogen peroxide, leads to

a deficit in hydrolizing capacity which has to be corrected.

The water lost in the production of hydrogen peroxide can be replaced in various ways. Some producers are adding fresh solution of electrolyte or even water at several stages during the distillation. Other producers introduce steam. Steam is slightly less active because the contact conditions are less suitable. However, it offers the advantage of saving evaporating surface. The steam supply process reaches a better heat economy. It consists of staging the pressure during the hydrolysis operation, bringing the vapors into contact again with the liquid stream partially in a counter-current flow.

Fast operation and heat supply is necessary in order to prevent catalytic decomposition which always occurs when the concentration of hydrogen peroxide increases. This is due to the violent reaction with Caro's acid and liberation of molecular oxygen. The close combination of hydrolysis and distillation is the most practical method for obtaining high efficiency. It is practiced automatically in the old batch conversion potassium process, since water is supplied as steam, while the pasty mixture of $K_2S_2O_8$ and H_2SO_4 contains the solid stock of fixed oxygen which reacts gradually. Thus water and heat supply are simplified in the conversion process. On the other hand there are disadvantages caused by the intermittent type of work.

In the straight liquid process one piece of know-how which improves operation is a thin layer distillation under water adjustment. There are various ways and many patents describing the methods of obtaining large surfaces needed for heat transfer and adequate controlled evaporation. One of the large problems is found in materials of construction. As a rule the liquids are very corrosive and the high speeds of the stream within evaporating tubes cause considerable erosion. Therefore, the choice of materials is rather restricted. They must have a high thermal conductivity and high resistance against corrosion and hydrolizing effects on the side of the heating steam.

The straight liquid process vapors are dilute compared with the solid process. To concentrate them they must be put through a much more complicated concentrating system. The accompanying flowsheet shows a system which will produce concentrations up to 40 percent H_2O_2 .

To get higher concentrations (up to 98 percent) the H_2O_2 solution shown as product on the flowsheet is pro-

cessed further. This product is redistilled in a series of vacuum columns and is then concentrated to desired strength.

MATERIALS OF CONSTRUCTION

Lead was one of the metallic materials extensively used in distillation tubes. The durability is rather short because of disturbance of any film protection by the fast stream of reacting ingredients and the reduced resistance against persulphuric acid. In addition some alloys have been introduced for these operations. The hydrogen peroxide industry has been building up an important capital in know-how.

Ceramic materials have some advantages but low thermal conductivity. Particularly borosilicate glasses which were proposed and used extensively still offer the best advantages, both in the straight liquid and the conversion process which employs a continuous flow by fluidization.

Graphite is also used to give improved heat transfer at lower concentrations. Work along these lines resulted in development of a graphite distilling tube for hydrogen peroxide used shortly before the war by the author in his private research laboratory in Berlin. No information was delivered during the war because of the use of hydrogen peroxide for military purposes. However, similar materials are now available for general chemical use.

Increasing production capacities have focused attention on distillation technology and further improvements are now in view. The straight liquid process leads primarily to rather dilute distillates making the concentration equipment more complicated than in the case of the conversion process, where the electrolytic side is more efficient.

Patents have been granted on the common concentrating methods on the basis that they present particular advantages or new effects when applied to hydrogen peroxide. Some standard fractionating technology is used in concentrating hydrogen peroxide. However, double distillation may be considered as an important step in processing because it solves the problem of high purity. This is a basic improvement for the stability and the commercial value of the product. But concentrated H_2O_2 must be handled with care since it can be hazardous in inexperienced hands.

High-vacuum column designs are essential. The increased output of modern plants is based on better design and adequate control.

New proposed methods of manufacture impose some additional problems in connection with byproducts or impurities. Even completely new principles of concentration and purification have appeared and will probably be feasible. However, at this moment electrolytic manufacture dominates the field of supply.

UTILITY CONSERVATION

Continued from page 113

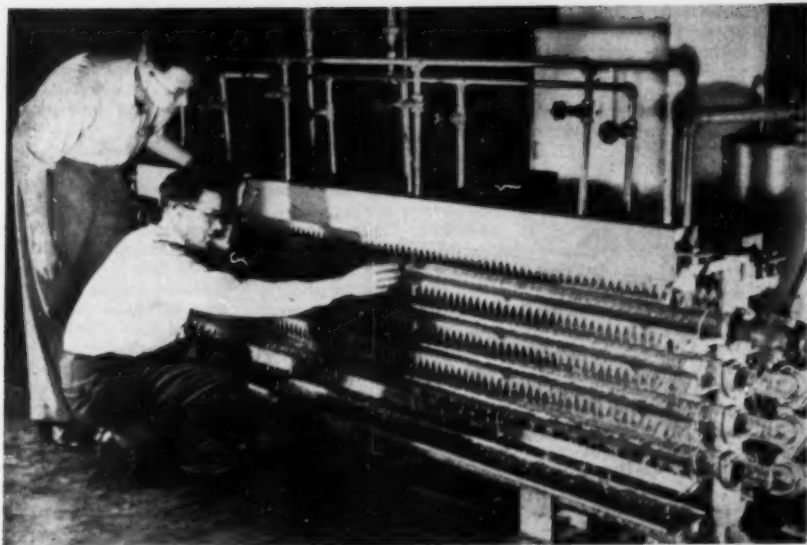
utilized dry ice, delivered by local suppliers, as the cold source. A monthly bill averaging close to \$2,000 for dry ice alone was the cost. An engineering study resulted in the installation of a single central refrigeration machine which serviced all the operations using a centrifugal compressor and freon refrigerant. Direct costs of operating this unit were \$1,000 per month less than the cost of the dry ice. In addition to this saving, the operations received consistently cold brine, never "ran out" over weekends or holiday periods, saved several thousands of dollars in dry ice handling and maintenance costs, and improved working and safety conditions.

One plant that utilized nitrogen gas for blanketing hazardous reactions found that carbon dioxide gas could be substituted, and realized a saving of \$2 per 1,000 cu. ft. The carbon

dioxide was found to be just as safe, and fully as effective as the nitrogen had been.

At another plant where large quantities of distilled water were used in the production of fine chemicals, a number of large stills were required to meet the demand. Steam consumption in these units was high, and formed an appreciable cost item. A utility study in this plant proved that waste steam condensate from a number of process points could be passed through an inexpensive filter bed and deionizer unit, and would give water that was just as satisfactory as distilled water for the manufacturing involved, and the cost of this water was less than 1/10th that of the distilled water.

In conclusion, let me recommend that rather than adopt the attitude that nothing can be done about utility costs, try instead the three methods outlined in this article, and watch the dollar results roll in. It can safely be predicted that the savings will amaze even the most hardened skeptic.



GLASS

ITS PLACE IN CHEMICAL PROCESSING

Although one of the oldest construction materials known, glass is just now coming into its own in the chemical processing field. This report tells the engineer why, where, and how the darling of the laboratory chemist can find applications in his plant. It covers not only glass in bulk form, but also as linings and fibers.

JULIAN C. SMITH

CHEMICAL ENGINEERING REPORT—APRIL 1951

3,000 yrs. B. C. WITH new materials of construction continually being developed, it is surprising to see a material some 5,000 years old holding its place in modern processing. Yet glass, which has been known since the days of ancient Egypt, is more than holding its own. A relative newcomer to plant-scale operations, it is finding wider and wider acceptance. Glass has provided the answer to some very difficult plant problems;

JULIAN C. SMITH is associate professor of chemical engineering at Cornell University, Ithaca, N. Y. His most recent contribution through these pages was an article published two months ago on glass bubble-cap columns. He and the co-author of that article, E. F. Keim, of Corning Glass Works, are studying the performance of a glass cascade cooler in the above photo.

it has made possible new processes; it has even displaced other materials of construction that were previously considered adequate. No longer restricted to the laboratory, glass has a promising future in industrial processing.

Glass is used in three forms that are of interest to the process engineer: (1) in bulk, in fairly large pieces of equipment, such as pipe, towers, and pumps; (2) as a coating, over steel and cast iron, as in tanks, reactors, and pipe; (3) as fibers, in insulation, fabrics, tower packings, and plastic laminates. Fused silica finds more restricted use in industrial work; some processing equipment, such as vessels and pipe, is made from it, and it has other specialized applications.

The term "glass" applies to a multitude of products—some 500 different formulations are

Bulk,
coatings,
fibers

kinds

commercially used. All glass is amorphous, non-crystalline, rigid and hard at room temperature. Glass nearly always contains silica as its principal ingredient.

Four main types The four main types of glass, classified according to composition, are lime glass, lead glass, borosilicate glass, and high-silica glass. Of these, only the latter two are of much interest as materials of construction in process work. Pure fused silica, although not strictly a glass, is enough like glass to warrant inclusion here. Compositions and properties of borosilicate glass, high-silica glass, and fused silica are given in Table I below.

Chemical properties The corrosion resistance of glass and glass coatings is summarized in Table II (next page). Although fairly inert to most chemicals, borosilicate glass is attacked rapidly at room temperature by hydrofluoric acid, fluorine, and some metallic fluorides. At temperatures above 100 deg. C. concentrated phosphoric acid and strong alkalis begin to attack glass appreciably. The presence of small amounts of salts and other agents considerably slows down attack by alkalis, however. A glass with a greatly improved resistance to alkalis is reported to be under development.

A phosphorus oxide glass, containing no silica, was announced in 1946. It was said to be inert to HF and fluorides. But the advent of polyethylene containers for handling fluorides has pretty well obviated the need for such a glass.

Pure silica is even more chemically resistant than borosilicate glass. Attack by HF is only about one-tenth as rapid, and most other agents have no effect at all.

Physical properties Glass has many desirable properties as a material of construction. Some of them have been made use of for years; others are only now being exploited. Glass is almost perfectly elastic. Its chemical inertness, surface hardness and smoothness, low coefficient of expansion, and transparency have led to its extensive use in laboratory ware and in many plant-scale applications. Its low electrical and thermal conductivities are sometimes advantageous, sometimes not.

Some properties of glass, however, are not so desirable, and severely limit its use in large equipment. The chief drawback of glass is that it breaks. Intrinsically, glass is exceedingly strong, with an ultimate strength of 1,000,000

psi. In fiber form this strength can sometimes be achieved, yet in bulk its strength is but a small fraction of this value. It is brittle, too, has low impact strength, and tiny surface defects lead to localized stress concentrations that reduce the working strength of ordinary annealed glass to about 1,000 psi.

Within recent years two methods have been devised for exploiting glass's extremely high intrinsic strength: tempering bulk glass, and drawing out glass in fiber form. In tempering, the surfaces are rapidly cooled to set up strong compressive stresses, with corresponding tensile stresses inside. Since glass fails in tension from the surface, the compressed surface of a tempered piece resists impact two to six times better than does that of annealed glass. Fibrous glass, possessing a very high strength-weight ratio, is coming into increasingly wide application as a reinforcing material for plastics, rubber belting, steam hose, industrial papers and tapes, and in coated fabrics. Fibrous glass has strengths as great as 200,000 psi.

Glass has some interesting properties which are not very well known. It vaporizes at measurable rates even at 200 deg. C. It has some catalytic effect, as has been shown in studies of the acetylation of ethanol and the reaction of oxygen with atomic hydrogen at low temperatures. Quartz has the lowest coefficient of expansion known, about half that of Invar and about one-sixth that of borosilicate glass.

Glass can be made transparent to a considerable amount of ultraviolet light. Transparency to ultraviolet increases with silica content; fused quartz is the most transparent commercial solid known. It transmits light with high efficiency from the short ultraviolet (1,850 Å) to the long infrared (40,000 to 70,000 Å).

Availability, above all, is one of the chief advantages of glass. Before and during World War II, glass substituted for many other materials both here and in Germany. All the raw materials for glass are available in the United States. Substitution enforced by current alloy shortages will probably give an impetus to the already expanding use of glass in process work. Glass equipment is rarely more expensive than that made from corrosion-resistant alloys. With the improvements in technology that have been made in the past ten years, it is probable that,

How to use its strength

Now you know

Substitute makes the first team

Table I—Properties of Glass and Fused Silica

	Borosilicate Glass	High-Silica Glass	Fused Silica and Quartz
Trade name	Pyrex	Vycor	Amersil, Vitrocell, etc.
Approximate composition, percent			
SiO ₂	80	96	99.6-99.8
B ₂ O ₃	14	3	—
Na ₂ O	4	1	—
Al ₂ O ₃	2	—	—
Ultimate tensile strength (bulk), psi.	10,000	10,000	400-4,000
Maximum working stress, psi.	1,000-4,000	1,000-4,000	—
Modulus of elasticity	9.8x10 ⁶	9.7x10 ⁶	9.7x10 ⁶
Thermal expansion coefficient per deg. C.	32x10 ⁻⁷	8x10 ⁻⁷	3.4x10 ⁻⁷
Annealing point, deg. C.	555	910	1,120
Softening point, deg. C.	520	1,300	1,750
Working point, deg. C.	1,220	—	—
Maximum working temperature			
Normal service, deg. C.	220*	800	1,000-1,100
Extreme limit, deg. C.	490*	1,050	1,400†
Specific gravity	2.23	2.18	2.07-2.21
Refractive index (N _D)	1.474	1.458	1.45866
Hardness, Moh scale	5-7	5-7	5-7
Thermal conductivity, Btu./hr. (sq. ft.) (deg. C./in.)	8.1	—	0.6-10.2
Specific heat, Btu./lb. (deg. C.), (mean, 25-175 deg. C.)	0.30	—	0.184

*For annealed glass. The values for tempered glass are 280 and 260 deg. C. †Provided the piece is never cooled below 300 deg. C.

Table II—Attack of Common Chemicals on Glass Linings*

Chemical	Degree of Resistance	Rate of Attack, Mils/Yr.	Remarks
Acetic acid	Excellent	0.01 (25 deg. C.); 0.08-0.46 (boiling)	Used for chlorination, esterification, sulfonation of acetic acid
Ammonia	Fair	Low at 25 deg. C.; 12.3-30.4 at 80-100 deg. C. (vapor); 3.3-3.6 (liquid)	Figures for 5-10 percent NH_4OH ; lining attacked above liquid level
Caustic soda	Poor	0.17-0.28 at 20 deg. C.; 2.5-20 at 65 deg. C.; 17-100 at 100 deg. C.	Figures for 1-30 percent NaOH
Chlorine	Very good	—	Resistant to wet chlorine at 175 deg. C.
Fatty acids	Entirely resistant	—	Used for making quality cosmetics, storage of oleic acid
Hydrochloric acid	Fully resistant	—	Used for all concentrations and temperatures
Hydrofluoric acid	None	Very rapid	—
Hydrogen peroxide	Excellent	—	H_2O_2 up to 35 percent is shipped in glass carboys
Nitric acid	Excellent	0.01 at 25 deg. C. (1-72 percent acid); 0.01 to 1.20 at boiling (1-69 percent acid); 0.4 to 1.7 at 70 deg. C. (fuming)	Widely used for all concentrations
Phosphoric acid	Fair to poor	Slow at 25 deg. C. when acid is fluoride free, and for up to 40 percent when hot. Life with hot acid stronger than 60 percent is 1-3 yrs.	Cannot be used when acid contains even traces of soluble fluorides
Sodium chloride	Excellent	—	Good for all concentrations
Sulphur	Fully resistant to solid, liquid, and gas	—	Not usually used
Sulphur dioxide	Good	—	Used in reactors for wet or dry SO_2 and for H_2SO_4 with very highly-resistant lining
Sulphuric acid	Entirely satisfactory	0.004-0.020 at 25 deg. C.; nil to 1.48 at boiling	Handles all concentrations to 230 deg. C.

*Condensed from Reference 5. The resistance of glass in bulk is similar; see Reference 7.

once glass is used in many new places, it will continue to be used. Fibrous glass-reinforced plastics, on the other hand, cannot be considered in this same category, inasmuch as they themselves require for their manufacture materials which are in short supply. Reinforced plastics, therefore, have in many applications superseded, rather than substituted for, other construction materials.

Practical problems Fabrication difficulties have long been a major deterrent to more widespread use of glass. Glass has no true melting point, and even when "molten" it never becomes really fluid. The viscosity of borosilicate glass at the working point of 1,200 deg. C. is 10,000 poises.

As the silica content rises, fabrication difficulties increase. Silica has a "melting point" of 1,750 deg. C., but even at higher temperatures it remains exceedingly viscous. For this reason, high-silica glass articles are fabricated from borosilicate glass and are then given a chemical treatment which leaches out nearly everything but the silica. They are then refired at 900 deg. C. to consolidate the glass.

Pure fused silica With pure fused silica no such trick can be played. Silica ware commonly is manufactured by surrounding a carbon or graphite electrode with high quality silica sand and passing an electric current through the electrode. The sand adjacent to the electrode reaches a temperature sufficiently high to fuse, although it is impossible to prevent the inclusion of air bubbles within the fused mass. The thickness of the fused layer is determined by the time allowed for fusion. The inner surface of the cylinder, being essentially in contact with the electrode, is fairly smooth, while the outer surface, determined by the temperature gradient through the mass of sand, is rough and sandy.

The hot fused silica cylinders are removed from the furnace and blown or mechanically shaped as quickly as possible, while still soft enough to work, into standard simple shapes. Sand-surface silica can be drawn into shapes

with more closely controlled dimensions, resulting in a product with a smoother surface, known as satin-surface silica. This material, however, still contains air inclusions. Fused silica, therefore, is not used where transparency is desired.

Pure silica products for applications requiring high transparency are made from Brazilian rock crystal by a process in which the entire silica mass is fused and air bubbles are eliminated. This material is more commonly termed fused quartz, to distinguish it from the lower quality fused silica. Because of its high cost its use is limited to special applications.

Machines for working glass have been improved so in the last decade that it is now possible to do many things considered impractical not long ago. Tolerances on drawn tubing have become much tighter. With modified metal working machines it is feasible to drill and saw glass to accurate dimensions; with diamond circular saws, tubing up to 4 in. in diameter is cut as a usual thing. Flat plate is also cut with saws.

The recent invention of electric welding of glass has made it possible to join lengths of heavy-walled tubing and pipe. It depends on the principle that glass conducts electricity at elevated temperatures. The glass is first heated with a gas flame to a moderate temperature, then a high-frequency electric current, carried from electrodes to the glass by the flame itself, is applied. In a few seconds a uniform homogeneous joint is formed, even with thick-walled tubing and pipe.

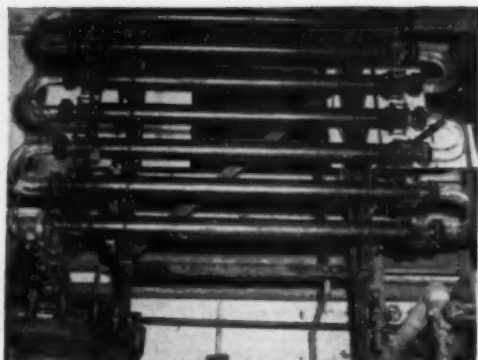
Another recent improvement is a machine for truing the ends of glass pipe. It stretches the pipe a trifle to the exact length specified, and insures that the end is square. Complicated glass objects can be fabricated by the multiform process. High-silica glass is molded, like clay, into complex shapes, which are then fired. The resulting articles are opaque, but they have the corrosion resistance and other desirable properties of high-silica glass.

Fused quartz

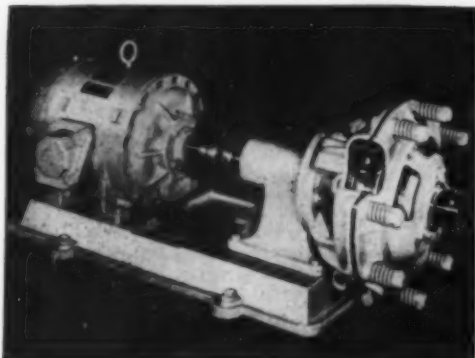
Electric welding



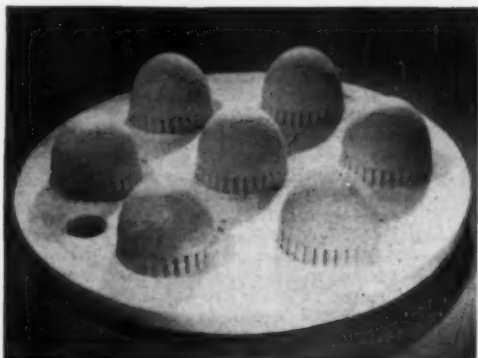
GLASS PIPING offers the invaluable asset of transparency. When something goes wrong, you can quickly tell why and where. Outdoor lines are not uncommon, as witness this Heyden Chemical Co. installation of 4-in. and 6-in. glass pipe.



DOUBLE-PIPE EXCHANGER is made of glass pipes held concentrically inside standard steel pipe jackets by stuffing boxes. The glass pipes are joined in series with standard glass U-bends. Jackets are also connected in series.



GLASS PUMP is made in two sizes: $\frac{1}{2}$ in. by 1 in., with a rated capacity of 20 gpm. at 10 psi. discharge pressure; and $1\frac{1}{2}$ by 2 in., handling up to 100 gpm. at pressures up to 30 psi. They use a rotary shaft seal.



BUBBLE-CAP COLUMNS for distillation and absorption can be constructed from high-silica glass plates such as this 24-in. diameter one. The 4-in., 6-in., and 12-in. sizes carry only one cap per plate. Plate efficiencies are high.



FITTINGS for glass pipe installations are available in various shapes, made throughout of tempered glass. Largest in above group is 4 in. I. D.



FUSED SILICA pipe normally employs bell-and-spigot joints, although gasketed joints are used with the very small sizes.



FUSED QUARTZ tubing provides unique combination of transparency and corrosion resistance for high temperature applications.

Glass Equipment for Plant-Scale Operations

Laboratory chemists become so accustomed to using glass equipment that they sometimes find it hard to think in terms of other materials of construction for plant-scale equipment. Although the prospects of extremely large glass processing units are not good, it is now possible to a considerable extent to talk about full-scale plants in glass. Standard glass units of considerable size, including pipe, pumps, heat exchangers, and distillation columns, are commercially available. Although small glass vessels are on the market, large vessels are nearly always glass-lined. Now that gasket materials such as Teflon are available, it is possible to construct complete corrosion-proof plants with no weak spots.

Piping is big business The biggest single use of glass in plant work has been, and probably will continue to be, as piping.¹¹ Glass pipe is coming into use even in competition with other materials of construction. One contractor has been known to say that he would just as soon put in glass pipe as metal pipe. In food and dairy plants in particular, glass pipe is becoming almost standard. Some plants have installed many miles of it,¹² and its use is increasing. It has the advantages of transparency, corrosion resistance, and ease of cleaning. Continuous photochemical reactors have been made from lengths of glass pipe, set in banks between batteries of ultraviolet lights.

Beware of thermal shock For service at temperatures below 120 deg. C. no special precautions are needed. Operation at temperatures up to 200 deg. C. is fairly common, but for these higher temperatures the pipe must be carefully protected from thermal shock. As with all other glass articles, sudden cooling is more dangerous than sudden heating. Glass is weak in tension, and rapid cooling sets up tensile stresses at the surfaces where failure is most likely. Tempered glass and high-silica glass are less vulnerable to thermal shock.

Glass pipe and fittings are supplied in standard sizes of 1, 1½, 2, 3, 4, and 6 in. I.D., with wall thicknesses from 5/32 in. to 21/64 in. Straight pipe is made in standard lengths up to 10 ft.; the smaller sizes are also supplied on special order in lengths up to 20 ft. The cost and difficulty of shipping pieces over 10 ft. long, however, make their use uneconomical in most cases. The length tolerance is normally 1/32 in. The normal maximum working pressure is 50 psi. for sizes up to 4 in., although pressures up to 100 psi. have occasionally been used; 6-in. glass pipe is limited to about 20 psi.

Making connections Pipe is supplied with either flanged or plain ends. Conical flanged ends of tempered glass are used with gasketed joints. These joints consist of rubber, asbestos, or Teflon gaskets held between the broad end faces of the pipe sections, and compressed by tie bolts and metal flanges. Glass spacers, ½ to 2 in. long, may be used for minor adjustments in length. Glass pipe can be joined to metal pipe with ASME 125-lb. standard flanges; to metal tubing with stainless steel tubing ferrules; to glass-lined pipe with a special adapter set; and to IAMD dairy fittings.

Field assembly Recent advances have made it possible for ordinary pipefitters, with some training, to cut and weld glass pipe in the field. Cutting is done with a specially designed tool available from the glass pipe manufacturer. The ends are joined by use of a portable high-frequency electric welding unit, similar to the machines used for making glass pipe and equipment, and the joints are annealed with a small portable electric furnace. Cutting and joining takes 10 to 15 min.; annealing takes another 15 min.

Glass pipe needs to be well supported and to be protected from accidental impact by a worker's wrench or the back of a truck. Other than this, however, it can be treated much like any other kind of pipe. Standard pipe hangers, lightly padded to avoid scratching the glass, are entirely satisfactory. In horizontal lines, span lengths between supports should be about 9 ft. for light liquids and about 7 ft. for heavy liquids such as concentrated sulphuric acid. Vertical lines up to 30 ft. long can be supported with rubber-lined clamps; longer vertical lines are held by spring-supported clamps.

Glass slip joints are available, but because of the low coefficient of expansion they are required only when straight lines with fixed ends are subject to a thermal expansion of ¼ in. or more. Gasketed joints permit some flexure and misalignment. A 10-ft length of 1-in. pipe can be offset 1½ in.; with 4-in. pipe the permissible offset is ½ in. Connection to vibrating machinery is entirely feasible, provided care is taken to prevent the motion from straining the glass. Sometimes two or three gaskets are used at the joints to absorb vibration.

Glass valves Small glass valves are used to some extent. Straight plug valves are available for 1-in. and 1½ in. pipe; spigot type valves are supplied in the 1-in. size only. Metal, porcelain, and glass-lined valves are more commonly used, however.

While glass pumps have not yet gained as wide acceptance as glass piping, many have been installed, especially on applications where all else has failed. You might say that they handle the very toughest pumping problems. They require more than ordinary care in installation and operation.

Centrifugal pumps The Nash pump uses a rotary seal instead of a stuffing box, which imposes several limitations: (1) The suction line must always be full—the pump cannot be run dry without damage, since the seal is cooled by liquid from the pump. (2) The suction pressure cannot exceed 10 psi. (3) The pump cannot handle liquids carrying solids. (4) Additional cooling of the seal must be supplied if the suction is under vacuum. (5) The fluid temperature cannot exceed 65 deg. C. with standard design, or 90 deg. C. with special design. These limitations obviously restrict the use of glass pumps to such problems as pumping hot hydrochloric and sulphuric acids, hot chlorinated solvents, and similar nasty materials. When properly used, however, glass pumps are entirely satisfactory. They combine corrosion resistance and transparency, as does no other pumping equipment.

Dual flow case pump The Tungstone pump, which has been popular in Europe for many years, is now available in glass. It works like an automatic blow case. Two small parallel chambers equipped with check valves and solenoid-operated air valves alternately fill and empty as air pressure is applied and released. The admission of air is regulated by a timer. The new glass model handles 6 gpm. at a discharge pressure of 50 psi. with a 4-ft. suction head. It will not draw a vacuum on the suction, but in other respects it is more versatile than glass centrifugal pumps. It can handle liquids containing moderate amounts of solids; running dry is not seriously damaging. It can stand temperatures to 200 deg. C.; this means it can be cleaned with steam. It requires from 1½ to 4½ cfm. of free air, depending on the discharge pressure.

Cascade coolers In the United States most glass heat exchangers are made of special glass pipe, either as cascade coolers or jacketed double-pipe exchangers. In cascade coolers two parallel banks of bare pipe are used, loosely held to brackets supported on vertical pipes near the end of the cooler. The fluid to be cooled enters the bottom pipe of one bank and passes upward through the pipes in series, alternating from one bank to the other.

Cooling water is admitted at a controlled rate to a distributor trough above each bank. The water flows as a film over each tube; notched strips suspended between each pair of pipes redistribute the flow over the pipe beneath. Cascade coolers in general make effective use of small amounts of cooling water.

Heat transfer rates These coolers have the advantages of simplicity and transparency. They can handle any corrosive material that is normally handled in glass pipe. The rate of heat transfer, despite the low thermal conductivity of glass, is not as small as might be expected. For one thing, the special heat transfer pipes have thin walls (0.06 to 0.08 in. thick), and sealing and fouling are usually negligible. At low water rates the distribution of the cooling water is not good, and at very high water rates splashing is severe, but over a considerable useful range, between about 0.8 and 1.5 gpm. per ft. of pipe, the distribution is good and the heat-transfer coefficients are high. For a typical unit with 2-in. pipes, under the proper conditions, the film coefficient of the cooling water outside the tubes is in the range of 300 to 800 Pcu./(hr.)(sq. ft.)(deg. C.) The corresponding over-all coefficient between cooling water and a hot liquid is 50 to 70; between cooling water and condensing steam, about 90.

Jacketed heat exchangers Double-pipe exchangers usually employ glass pipes between 1 in. and 2 in. in diameter. Cascade units involve 2-in. pipe for condensation and liquid cooling, 3-in. (and occasionally 4-in.) pipe for gas cooling. There is almost no limit to the amount of heat-transfer surface that can be supplied in a double-pipe exchanger, but cascade units are limited to about 15 tubes in each bank, or 30 tubes altogether. With 2-in. tubes 10 ft. long, the total cooling surface is 167 sq. ft.

In Europe, and particularly in England, heat exchangers are often made in the form of long

glass coils set in glass pipe or vessels.^{11, 12} Single coils containing 150 ft. of 2-in. tubing in a helix 3 ft. in diameter have been made. Such units are very expensive and very fragile. Smaller units are in commercial service in a number of places, however, as condensers, reboilers, and in packed towers with controlled temperatures. Typical condensers provide from 3 to 25 sq. ft.; they are 3 to 12 in. in diameter and up to 30 in. long. They can operate under vacuum or under pressures up to 50 psi. A typical over-all coefficient from water to condensing steam is 50 Pcu./(hr.)(sq. ft.)(deg. C.).

Small packed columns are often made from lengths of standard glass pipe. Glass rings are sometimes used as packing, but porcelain or clay packing is more common. The packing is supported on metal grids or on high-silica glass perforated plates made by the multiform process. Larger packed and sieve-plate columns are made from relatively short cylinders of glass, held between perforated plates of high-silica glass. A glass distributor head has been developed for use in falling-film absorption towers.

Bubble-cap columns All-glass bubble-cap columns have recently been announced.¹³ Plate, caps, and risers of high-silica glass are fused into a single strong unit, held between lengths of borosilicate glass pipe or tubing with gaskets and external tie rods. The downcomers are borosilicate tubing, set into holes in the plates with sleeves of Teflon. The gaskets are rubber, Teflon, or asbestos.

These columns differ from earlier glass bubble-cap columns in that they are reasonably easy to install and require no very special handling. Plate efficiencies are at least as high as that of similar metal columns. They can operate under vacuum or under pressures up to about 10 psi. In the distillation of sensitive monomers, where contamination by metal cannot be tolerated; in the distillation and absorption of corrosive materials, particularly chlorinated compounds; in instruction of students and still operators; these columns have already found considerable use.

Vessels and tanks Glass vessels are usually so small as to be impractical for plant-scale work except in very specialized processes. Round bottom flasks as large as 19 gal. are used in some pharmaceutical work.¹⁴ In England, 26-gal. flasks are available.¹⁵ The largest open glass vessels usually supplied are 2 ft. in diameter and 18 in. deep, with a flat bottom (35 gal.); larger units, up to 70 gal. in size, have been made on special order. There is little call for open cylindrical tanks of this kind, except as bodies for electrolytic cells, and there is little real demand for large glass vessels.

Glass tubing Borosilicate glass tubing is supplied with standard outside diameters from ¼ in. to 4½ in., in intervals of ¼ to ½ in. Wall thicknesses range from 1/46 to ½ in. On special order, machine-drawn tubing 6½ in. O.D. can be supplied in lengths up to 6 ft. Hand-blown cylinders, 5 to 23½ in. O.D., are also standard items. The standard tolerances, especially on the larger sizes of tubing, are not very close, but tubing can be specially ordered with much closer tolerances, and tubing with machine-shop tolerances on the inside diameter is commercially available. Cir-

cular tubes, tapered tubes, tubes with elliptical, rectangular, and other cross-sections, with tolerances of 0.0005 in. or less, can be obtained.

Precision-bore glass tubing is customarily used in flow-meters. Cage glasses for level indication, at pressures up to 1,500 psi. are also common. Glass tubing is useful as sheaths for ultraviolet lamps set into reactors for photochemical reactions. In general, however, glass tubing finds little application in plant-scale work.

And so forth

Sight glasses made from disks of flat borosilicate plate are used in some pressure vessels, at a maximum of 150 psi. for a plate 4 in. in diameter, to 30 psi. for an 8-in. plate. Glass is sometimes used for steam jets, although it is restricted to rather low-pressure steam (70 psi.).¹²

Glass godet wheels are used for drawing viscose rayon out of acid spinning baths.

Glass might seem to be an ideal material for rupture disks on pressure vessels, but peculiarly it is not—it fails too slowly! It will fail at relatively low pressures, but it will stand two to six times as much pressure for short, but appreciable, periods. Glass safety disks have been used, but are not much favored.

High-silica glass finds only limited application in industry. It is used in the fabrication of complex pieces like sieve plates, bubble-caps, and perforated packing supports. It is also used in jars for calcining some minerals and as sheaths for electric resistance heaters. Its largest use, however, continues to be in laboratory ware.

High-silica glass

Fused Silica and Fused Quartz in Industry

Fused silica and fused quartz are both about 99.8 percent SiO_2 . Both permit high working temperatures; both are highly resistant to corrosion. Fused quartz is transparent to visible light, whereas fused silica is translucent or opaque. In plant-scale work, fused quartz finds only very limited use, since it costs two to six times as much as fused silica.

High cost limits uses

The extreme difficulty of fabricating equipment of fused silica keeps its cost up and its industrial applications down. Even with the improved techniques now in use, it takes a lot of work to make equipment from fused silica, and its use is justified only when its advantages outweigh its cost. These advantages are its corrosive resistance, extremely low coefficient of thermal expansion, resistance to thermal shock, high softening point, and remarkable electrical properties.* The available shapes are necessarily simple; equipment is fabricated largely from basic flat and tubular components.

In high temperature applications, care must be taken to guard against devitrification. Although fused silica can be used at temperatures up to 1,400 deg. C., it devitrifies when held above 1,100 deg. C. for too long a time, and cannot subsequently be cooled without literally shattering to pieces. In practical applications where it is desired to operate near to, but under, the devitrification point, adequate provision must be made for good temperature control.

Fused-silica basins and vessels up to 60 gal. in size are used for such exacting work as the manufacture of fluorescent products and the refining of radium compounds. Flasks are used

for distilling special grades of sulphuric and nitric acids.

Pipe and fittings are supplied in sizes between 2 and 30 in., in lengths between 2 ft. 9 in. and 10 ft. The wall thickness varies between $\frac{1}{4}$ in. and $\frac{1}{2}$ in. Rectangular pipe is also available. Silica pipe normally employs bell-and-spigot joints, although gasketed joints are used with the very small sizes. Fittings include elbows, reducers, U-bends, S-bends, and laterals.

Silica pipe

HCl absorption is the most extensive single application of fused silica in industrial work. Absorbers are constructed of S-bends 4 to 10 in. in diameter, with 40 to 78 in. between centers, arranged in banks over which cold water cascades. Because of the properties of silica, it is possible to use direct cooling even when the gas inside the pipes is at 600 deg. C. Fused silica is used in bulk to a small extent as a tower packing and a catalyst support.

A rather specialized but highly important use of fused quartz is in irradiation tubes for photochemical reactions. Immersion heaters for electrolytic baths are commonly sheathed with silica; unlike glass, silica is electrically resistant even at elevated temperatures. It is now possible to spin silica into delicate fibers, which are used in analytical balances of extreme sensitivity. Precision bore quartz tubing is beginning to be used for flowmeter tubes where temperature and chemical attack eliminate glass construction. For all its remarkable properties, the use of silica in plant-scale work, however, is likely to remain restricted to special applications where no other materials will do.

Fused quartz uses

Glass-Covered and Glass-Lined Chemical Equipment

The use of glass-covered metal in industrial work could hardly be called new, since glass-lined tanks were first made some 80 years ago. The art of coating metal with glass, however, has come a long way since the first beer fermenter tanks were put on the market. Large storage tanks, tank cars, chemical reactors, pipe, valves, pumps, and other equipment lined or coated with glass are now available. Sometimes competitive, more often complementary, to glass

itself, glass-covered equipment is finding more and more applications in industrial processing.*

The base metal on which the glass is applied is fabricated by more or less standard methods into the desired shape. The surfaces to be glass-covered are thoroughly cleaned and ground smooth. A suspension of finely divided glass is then sprayed on, and the piece is heated in a gas-fired furnace to about 900 deg. C., fusing the glass into the so-called "ground coat." The

Coating procedure

glass for this coat is chosen for its bonding properties; is not highly chemically resistant. The bond between metal and glass, incidentally, is exceedingly good.

"Dry"
process

The procedure used following application of the ground coat depends on the size and prospective service of the unit being fabricated. For glass-lined vessels, two processes are in use. In the "dry" process, additional coats are applied by spreading dry powdered glass on the hot surface of the ground coat, soon after the piece is removed from the furnace. After each coat is applied, the piece is refired to fuse the added glass to the original coating. Because the dry powder must manually be applied to the surface, and because the operator must stand close to the very hot work, the dry process is limited to the manufacture of open vessels no larger than 500 gal. in size.

"Wet"
process

In the "wet" process, the work is cooled between each coat. Manufacture by this method takes longer and is somewhat more expensive than by the dry process. However, closed vessels can be made by the wet process, and there is no limitation as to size except the size of the furnace. Successive layers of glass are applied from water suspension and fused. When the vessel is open or large enough for a man to enter, dry powdered glass may be added on top of the wet layer of glass before firing. This increases the amount of glass that can be put on in each application.

The number of layers of glass depends on the service. For large storage tanks in mild service, such as beer storage, only two layers are applied. Visual inspection is used to find flaws in the glass coating. For more severe service an electric tester, which measures the electrical resistance of the lining, is used. Linings for storage tanks must stand 600 volts; chemical reactors require linings that can stand 20,000 volts.

Inspection
and
testing

Reactors are given very careful inspection, both visual and electrical, after two coats have been applied. Very often a third coat, and sometimes a fourth coat, is needed to reduce the number of electrical "breakthroughs" to the acceptable value. Some defects are permissible, the exact number depending on the size of the vessel. They are repaired before the vessel is shipped. Additional coats do not always reduce the number of defects satisfactorily, however, so that an appreciable fraction of the production must be reprocessed.

Other equipment, such as valves, pipe, pumps, agitators, and thermometer wells, are glass covered in much the same way as are process vessels, with few restrictions in design. One restriction is a minimum radius of $\frac{1}{4}$ in. on convex surfaces; adhesion to sharper bends is not good. The glass is subject to damage by impact, but not as much as annealed glass, because the method of manufacture puts the glass lining under considerable compression, much as with tempered glass.

Handle
with care

Provided reasonable care is used in handling glass-lined vessels, no difficulties or special problems arise in their installation. They should not be rolled across the floor, and should be lifted with ropes, not chains. It is not good practice, obviously, to weld anything to the outside

of the tank, since the glass on the other side of the weld will part company with the metal. It is sometimes desirable to protect the outside of the vessel from acid attack, for the reason mentioned later. Once installed, a properly-treated process vessel can be expected to last indefinitely.

This does not mean that repair of the glass lining is never required. The lining, even when surprisingly severely damaged, can be repaired. A heavy blow with a wrench or hammer usually means the end of the lining, and even smaller flaws, if left unrepaired, can lead to failure of the steel shell because of acid attack. If caught in time, however, damaged linings can be repaired by one of two methods. The older method is by filling the cavity with gold; a new procedure involves Teflon washers held in place with tantalum studs and buttons.

The gold filling process is very much like that used in filling teeth. The defect in the glass is carefully cut away, and the metal underneath is undercut slightly. Dentists' mat gold is tamped into the hole until the cavity is full. This method is limited to the repair of flaws no more than $\frac{1}{4}$ in. in size. It gives a smooth surface to the repaired glass lining, but is fairly expensive and requires a skilled worker, usually sent out by the manufacturer of the glass-lined equipment.

Painless
fillings

The principal disadvantage of the second procedure is that the tantalum buttons project outward from the surface of the lining, and cannot be used where perfect smoothness is essential. They give entirely satisfactory service, however. They are much cheaper than gold fillings; they can be used to cover much larger defects; they can be put in by the user of the equipment.

In repairing small defects, up to perhaps $\frac{1}{4}$ in. in diameter, a bolt or stud is screwed into the steel wall and surrounded with a special cement to discourage electrolytic corrosion. A large disk of waxy Teflon and a smaller disk of leathery Teflon are slipped over the stud and covered with cement. A tantalum button, held by the bolt head or a tantalum nut, pinches the disk of waxy Teflon against the glass. With larger defects, the button is replaced by a flat tantalum plate, held with several studs. Plates $\frac{1}{4}$ in. square and larger have been satisfactorily used. These buttons and plates should not be used in places where solids can accumulate on them; eventually they may be sheared off if the buildup becomes too great.

Tantalum
plus
Teflon

Glass-lined vessels usually fail because of accidental damage to the lining, or by chemical attack at some point other than on the lining itself. Most often the attack is from the outside. At the lips of the various flanges the glass covering stops. If the gaskets fail, corrosive liquid may flow over the flanges and work its way under the lining. Acid attack on the outside of the vessel may ruin the glass lining for another reason—the steel is pervious to the hydrogen liberated. The effect is not completely understood, and is far from predictable, but it is well known that if the outside of a glass-lined test cup is exposed to strong acid, the lining will fail in time. Depending on the temperature, acid strength, thickness of the metal, and other

Protect
the
exterior

factors as yet unknown, the time varies from a few hours to months or even years. In any case, it is good practice when a glass-lined vessel is to operate in a corrosive atmosphere to cover the outside with a suitable bituminous or rubber base coating. For the same reason, chemical removal of scale in the jacket should be done with alkaline hypochlorite, never with acid.

Gasket material and design are of great importance in glass-lined vessels. For low pressures and temperatures, rubber is almost ideal, but it does not have the strength and resistance for really severe service. Asbestos and other gasket materials have been used, with limited success.

Teflon
again

One of the major advances in recent years is the development of Teflon-covered gaskets. Teflon by itself is not sufficiently compressible to be satisfactory, but in combination with soft asbestos it has solved some of the very toughest problems. The most favored design is a Teflon sheath formed by two flat rings heat-sealed at the inside and covering one or more rings of resilient millboard asbestos.

Tanks and
vats

Glass-lined tanks generally employ a lining only two coats thick, often of non-acidproof glass. The quality and resistance of the lining in storage tanks is usually much less critical than in reactors. Nozzles and manholes are of conventional size and design, and at all the openings the radii of curvature are large. The glass coating covers the inside of the nozzles and is extended out to the edges of the flanges. Gasketed joints with vanstone flanges commonly join the nozzles to glass-lined, alloy, or glass pipe. Glass-lined tank cars are in wide use. Rectangular beer fermentation vats are made from flat glass-covered plates bolted together and sealed with rubber gaskets. Cylindrical tanks range in size from 5 to 30,000 gal.

Chemical
reactors

Glass-lined steel chemical reactors are fabricated for heavy duty under severely corrosive conditions. They do not, of course, have the transparency of glass equipment, but they take advantage of the other properties of glass for four principal purposes: (1) for resistance to attack by mineral acids, particularly hydrochloric, and by chlorinated solvents; (2) for preventing critical metallic contamination of pure products; (3) for ease of cleaning and maintenance of biologically sterile conditions; (4) for preventing adhesion of the product to the walls, particularly in synthetic rubber polymerization. Even when highly polished, metal polymerization vessels are impractical because build-up of polymer on the wall quickly reduces the rate of heat transfer through the wall almost to zero.

Glass-lined reactors, usually jacketed and agitated, are supplied in standard sizes between 2 gal. and 2,000 gal. Design pressures of 25 to 50 psi. internal pressure and 75 psi. in the jacket are customary. Special polymerization kettles, 3,000 gal. in size, operate at 150 psi.

Agitators

Most reactors are agitated, and most glass-covered agitators are rather simple in design. Three-bladed paddles, with round rods or flat, slightly pitched blades are most often used. Anchor agitators run a close second. The speeds are slow—some 50 to perhaps 150 rpm. The agitation is good, however, especially in baffled vessels, and any operation involving agitation, such as solu-

tion of solids, liquid mixing, or gas dispersion, can be carried out in glass-lined equipment. Baffles are necessarily somewhat different in design from those used in metal tanks, since they can not be attached to the wall of the vessel. Their position in the tank is adjustable to give the most effective swirl-stopping action.

In recent years the design of shaft seals has received a lot of study, and many problems have been solved. Stuffing boxes of more or less conventional design are fairly good, especially when using special porous Teflon rings. The sliding contact is made between the stationary packing ring and the machined end of a Hastelloy sleeve surrounding the shaft above the point where the glass coating ends. A loose stationary Teflon ring rubbing on the glass-coated shaft below the stuffing box is sometimes inserted to discourage vapor from reaching the packing. For less severely corrosive service, rotary seals involving a graphite ring rubbing against a polished alloy surface give leak-proof operation and eliminate other disadvantages of stuffing boxes. Dual seals with a hydraulically balanced sealing fluid are sometimes used.

Shaft
seals are
important

The agitator of a glass-lined vessel is removed through the manhole. This is one of the most ticklish operations the users of such equipment have to perform. A man in stockinged feet or wearing rubbers enters the tank. The stuffing box is loosened; the motor shaft is disconnected from the agitator shaft; the agitator is carefully lowered until the shaft can be poked through the manhole; and the shaft and blades are carefully maneuvered through the opening. When installing the agitator, the procedure is reversed.

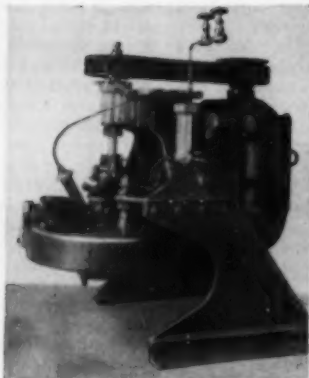
Heat
transfer
problems

The rate of heat transmission through the walls of glass-lined vessels is often of importance. Heat must pass through the film of the agitated liquid inside the tank, through the glass lining and the metal wall, and through the film of heating or cooling medium in the jacket. Through any layers of scale, too, and any material that adheres to the glass coating. The usual methods of promoting high heat-transfer coefficients in the jacket are not easily applicable to glass-lined equipment, since nothing can be welded to the outside of the tank once the glass has been applied. The jacket itself is put on in two pieces: a top ring welded to the tank before application of the glass, projecting outward and down 2 or 3 in., but not large enough to interfere with the annealing process; and the body of the jacket, welded to the ring when the rest of the vessel is complete. Spiral baffles inside such a jacket must be loose and are not particularly effective. A better method of improving the rate of heat transfer uses several nozzles in the jacket to direct the liquid stream tangentially against the outside wall of the vessel and swirl the jacket contents at high velocities.

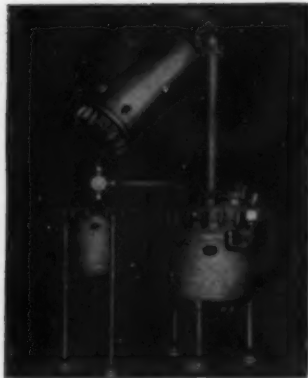
The metal wall, unless it is very thick, contributes little resistance to the flow of heat. The glass, however, has considerable resistance. The thickness of the lining, even in a particular vessel, may vary considerably, so that an average value of resistance is all that can be used. On an average the lining is about 0.06 in. thick, with a thermal conductance of about 115 Pcu./(hr.)(sq. ft.)(deg. C.).



CHEMICAL REACTORS employ linings of the highest quality. Usual maximum operating temperature is 230 deg. C.



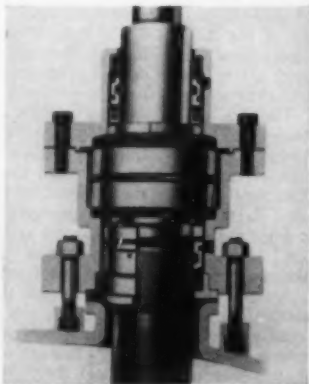
GLASS-LINED PUMP has a rated capacity of 200 gpm. at 40 psi. and 1,400 rpm. Connections are 3 in. by 2 in.



STILL ASSEMBLY is composed of jacketed vessel, condenser, receiver, pipe, and fittings, all of them glass-lined.



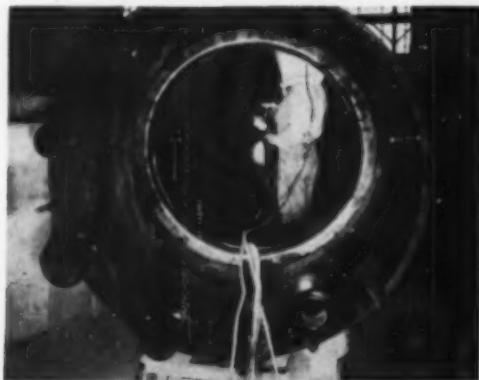
DRYER TRAY is glass-enameled. Composition of enamels differs somewhat from that of true glasses.



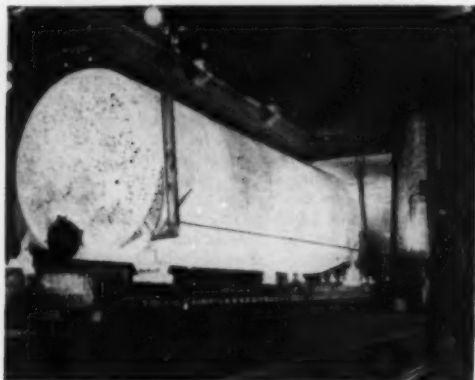
SHAFT SEAL is a weak point in agitated vessel design. This improved mechanical seal has helped solve this problem.



FLUSH OUTLET VALVES are used in glass-lined tanks. Internal pressure tends to keep them closed.



GLASS COATING is sprayed onto interior surface of cast iron or special low-carbon steel vessel. Fairly high design pressures are permissible, using steel up to 1½ in. thick.



GAS-FIRED FURNACE fuses the glass coating at 900 deg. C. The bond between glass and metal is probably molecular, as it has been shown that some iron migrates into the glass.

Liquid
film
coefficient

The conductance of the film of the agitated liquid depends on the nature of the liquid and the degree of agitation. With a thin, non-scaling liquid it is usually high, of the order of 300 to 600 Pcu./(hr.)(sq. ft.)(deg. C.). In such operations as the polymerization of rubber, however, the skin of latex on the glass surface has a much larger resistance than does the glass. The exact value of this film resistance depends on the amount of agitation. It has been found possible to control the rate of cooling and the temperature of the liquid in the vessel by varying the agitator speed. In one polymerization in brine-cooled vessels, the temperature of the agitated latex is automatically held at the correct value by connecting the temperature controller to the speed regulator of a variable-speed drive on the agitator.

Thermometer wells are also glass covered. New designs have reduced the lag in noting temperature changes by "restricting" the end of the thermowell which contains the temperature-sensitive bulb, so that much less liquid surrounds the bulb than in earlier models. The thermowells sometimes carry fins, and act as effective baffles. As are all other accessories in glass-lined tanks, they are inserted through the top.

Glass-lined
Pipe

Glass-lined steel pipe is sometimes a competitor of glass pipe, but more often it is a useful companion. In place of transparency it offers higher operating pressures and greater resistance to breakage. It is made in much larger sizes, from 1½ in. to almost any desired size. Most sizes are available in lengths up to 10 ft. Standard working pressures range up to 125 psi.; a line of 300-psi. glass-lined pipe is now available, and higher permissible pressures are in prospect. Standard flanged fittings are available in sizes up to about 12 in.

For joining pipe and fittings, separate cast or forged steel flanges compress a suitable gasket between the glass-covered vanstone flanges integral with the pipe. Finding the proper gasket material is not always easy, although choice can be made from a wide variety of materials. The gaskets should contain no material harder than tin or lead.

A recent Pfaudler development, called the "glassalloy" joint, is designed to permit length adjustment in the field by the use of screwed alloy joints.¹ Where limited contact of the fluid with a corrosion-resistant alloy is permissible, it is possible, of course, to use a screwed coupling with glass-lined alloy pipe, which can be cut and threaded as desired. This is almost always uneconomical, however, since alloy pipe is expensive enough in itself, and glass-lined alloy pipe is doubly so. The new type joint, however, uses short lengths of alloy pipe attached to the ends of steel pipe. The entire assembly after glass lining can be cut and threaded to exact length.

Valves use
porcelain
parts

Glass-lined valves have a glass-covered cast iron body and a porcelain valve head and valve seat. The head is carried on a glass-covered stem, which passes through a conventional stuffing box to a hand wheel with a smooth rim, so that it is hard to overtighten the valve. The valves are designed to stand the service expected of the vessel or pipe line in which they

are placed. Globe valves, either for throttling or for shut-off purposes, are available in sizes between 1½ and 3 in. in straight-through or angle patterns. Relief valves and pop-valves in the same sizes are used for safety purposes on glass-lined pressure equipment. Metal bodies of diaphragm valves, such as the Saunders type, are glass lined for chemical service.

The Pfaudler glass-lined pump is a centrifugal pump with a horizontal casing. The glass-covered impeller is driven from above. A stuffing box or rotary seal surrounds the impeller shaft, sometimes with a gas barrier between the liquid in the pump and the stuffing box or seal. The semi-open impeller must never come in contact with the casing, and consequently the clearances are somewhat larger than in metal centrifugal pumps. This pump cannot handle liquids containing abrasive solids, although sometimes this limitation is made less severe by using a metal impeller in place of the glass-coated one.

Centrifugal
pump

Jacketed glass-lined pipe, designed for a jacket pressure of about 40 psi., is a standard product. Successive lengths may be joined, as with jacketed glass pipe, into double-pipe heat exchangers with truly counter-current flow. Unjacketed glass-lined pipe is also used in cascade coolers, where its performance is much the same as with glass tubes. It can stand higher pressures and is less subject to damage by impact, but it is not transparent, and the outer surface is more likely to foul than in a glass cascade unit.

Heat
exchangers

Closed-end glass-lined heater tubes are often used as immersion heaters and coolers. Glass-lined double-jacketed condensers of the conventional tube and thimble type are made in sizes from 9 to 160 sq. ft. The corrosive vapor condenses in the annular space between the jacketed tube and flooded thimble. The rate of heat transfer is good, since both glass-covered surfaces are cooled.

Lengths of glass-lined pipe are often assembled into towers for absorption, reaction, and distillation. Ceramic and glass packings are commonly used.

Glass-enamelled equipment, with thin sheet steel as the base metal, finds some application in industrial work. There is some confusion between the terms "enameling" and "glass lining," principally because there is no sharp line of demarcation between the two. Both involve the application of vitreous coatings to metal. Enamels have somewhat different compositions than do glass, containing considerable pigment and filler. Enameling is restricted to thin sheets of metal; glass linings and coverings, as mentioned before, are applied to metal plate between ¼ and 1½ in. thick.

Glass
enameling

Companies like the Vitreous Steel Products Co. specialize in fairly small enamelled pieces, with standard or with acid-resistant glass covering. Die-stamped or spot-welded dryer trays up to 6 ft. in length are typical; deep drawn trays up to 14 × 22 × 8 in. deep are also available. These trays have the edges folded over, and are enamelled inside and out. Enamelled cascade pans, draining tanks, pails, conveyor buckets, heating and cooling coils, and enamelled filter screens—typically 6-mesh, 16-gage—are examples of enamelled equipment that is on the market.

Industrial Applications of Fibrous Glass

No discussion of the place of glass in industrial processing would be complete without some mention of the use of fibrous glass in various applications. Here the use of glass has been greatly broadened during the past decade. It is not very long since an economical process for making fibrous glass was developed, and already this new building and engineering material has proven of immense value.

How it is made

Fibrous glass is made in three basic forms—in yarn or textile fibers having an outward resemblance to other synthetic fibers; in glass wool, used for thermal and acoustical insulation; and in relatively coarse mat form, used for various filtration and tower packing applications. In the manufacture of fibrous glass, molten glass of a special composition flows in tiny streams through small openings or bushings in the bottom of the tank. Glass wool is formed by blowing the glass with sharp jets of steam onto a conveyor in a soft woolly mass. Glass mat is formed by compressed air jets in similar fashion.

Fibrous glass yarns are produced in two forms—continuous filament and staple fiber. The filament yarns are drawn at high speed from the bushings onto a winding mechanism. Staple yarns are blown by compressed air onto a revolving drum, from which they are gathered in a strand. Individual glass fibers range in diameter from 0.00006 to 0.0080 in.

Thermal insulation

One of the major uses of fibrous glass is in thermal insulation. Glass wool is efficient under temperatures up to 550 deg. C., or in preformed resin-bonded shapes, for temperatures below 300 deg. C. The somewhat coarser filaments

are used as separator mats for batteries and pipe wrap for corrosion control.

Coarse glass fibers are made into packs for air filters, for removal of dirt, fly ash, and other solid particles. Typical panels are 20 in. square and 1 to 2 in. thick. Fibrous glass filters have the advantages of chemical inertness, high working temperatures, low pressure drop, and high dirt-holding capacity.

Tower packing

Coarse glass fibers have also found considerable success as tower packing. The favored bulk densities range from 34 to 6 lb. per cu. ft. The corresponding surface areas are large (135 to 232 sq. ft. per cu. ft.) as are the void spaces (about 97 percent). In the distillation of ethanol in a 50-in. column, 32 ft. high, replacement of bubble-cap trays with sections packed with glass fibers greatly increased the productive capacity of the unit. The separation efficiency was good and the pressure drop was low. Superficial vapor velocities up to 6 fps. have proven feasible.* Packed towers are also in service for the removal of entrained sulphuric acid from the gases leaving an SO₂ scrubber, in gas absorptions and fume scrubbing,** and in a number of liquid-liquid extraction processes.

Emulsion breaking

In petroleum refining, glass fibers have replaced excelsior for desalting crude oil.*** By passing oil through beds of glass fibers at velocities of 0.25 to 1.0 fpm., the salt content can typically be reduced from 200 to less than 5 lb. per 1,000 bbl. of crude, by coalescing the droplets of brine and permitting easy separation. Glass fibers have also been used as a catalyst support.

Among the many uses for glass cloth is the

Table III—Manufacturers of Glass and Glass-Covered Equipment

Manufacturer	Address	Products
Glass Equipment		
Corning Glass Works	Corning, N. Y.	Glass vessels, pipe, valves, fittings, sieve-plate and bubble-cap columns, heat exchangers, etc.
Diets Chemical Glass Works	1975 E. 65th St. Cleveland 17, Ohio	Special applications of glass in industrial processing
Nash Engineering Co.	South Norwalk, Conn.	Glass pumps
Quickfit and Quartz, Ltd.	1 Albionville St. Pondicherry, London W1, England	Glass pipe, vessels, heat exchangers, packed columns, etc.
Tungstone Products, Ltd.	Market Harborough Leicestershire, England	Glass pumps
Fused Silica Equipment		
Amsel Co.	Chestnut Avenue Hillsdale, N. J.	Fused silica equipment
Corning Glass Works	Corning, N. Y.	99% silica glass clear tubes, cylinders, calcining jars, sight glasses, gas sampling tubes
General Electric Co.	Schenectady, N. Y.	Quartz fiber
General Engineering Lab'y		
General Electric Co., Lamp Dept.	Cleveland, Ohio	Clear and translucent fused quartz tubing, sight glasses, laboratory ware
Hanovia Chemical and Mfg. Co.	100 Chestnut St. Newark 6, N. J.	Special shapes to specification, rod, tubing, windows, special optical grades of quartz in many forms and precision bore tubing
Electrical Div.	12 E. 49th St. New York 17, N. Y.	Fused silica crucibles, dishes, flasks, pipe, fittings, transparent quartz tubing, laboratory ware
Thermal Syndicate, Ltd.		
Glass-Lined and Glass-Covered Equipment		
Glasco Products, Inc.	20900 St. Clair Ave. Cleveland 17, Ohio	Glass-lined pipe, tanks, fittings, reactors, heat exchangers, etc.
Flasidier Co.	1000 West Ave. Rochester 3, N. Y.	Glass-lined pipe, valves, fittings, tanks, reactors, heat exchangers, etc.
A. O. Smith Corp.	Milwaukee, Wis.	Glass-lined storage tanks
Vitroco Steel Products Co.	Box 1791 Cleveland 5, Ohio	Enameled trays, pans, coils, pans, screens, etc.
Glass Fiber Products		
Glass Fibers, Inc.	Waterville, Ohio	Insulation, glass fabrics, pipe wrap, air filters, battery separator mats
National Filter Media Corp.	New Haven 14, Conn.	Glass fiber cloth
Owens-Corning Fiberglas Corp.	Toledo 1, Ohio	Glass fibers, insulation, pipe wrap, tower packing, air filters, separator mats, etc.
Wm. W. Stanley Co.	401 Broadway New York 13, N. Y.	Glass filter cloth
The Roofing Co., Glasgow Div.	Hicksville, N. Y.	Pipe wrap, battery separator mats, air filters
U. S. Plywood Corp., Glasco Div.	55 W. 44th St. New York 18, N. Y.	Glass-plastic laminated pipe and fittings



PIPE WRAPPED with glass cloth provides corrosion resistance in underground installations. This particular job is a Sun Oil Co. line running from Toledo to Sarnia, Ont.

filtration of hot acids. Filter cloths and bags are supplied for plate-and-frame filters, rotary filters, nutsches, and centrifugals of any size. The seams and non-selva edges are sewn and reinforced with glass thread. Edges of filter press cloths are normally covered with rubber latex for a distance of $\frac{1}{4}$ in. inside the sealing surfaces. The latex protects the glass cloth from damage by abrasion, helps to make a liquid-tight joint, and reduces wickage.

Although there is almost no temperature restriction on the use of glass fiber cloth, other precautions must be observed. The cloth should be treated periodically with oil. It should never be mechanically scraped, nor should it be sluiced with high-velocity streams of liquid. It should be protected from flexing due to pressure fluctuations, and it should not be used with metal parts that have sharp edges.

Plastic laminates

Fibrous glass in mat, chopped fiber, and cloth form is used as reinforcing material for plastics to produce molded and laminated products having low density and great strength. Suitable plastics are the polyesters, phenolics, melamines, and silicones. Tensile strengths range up to 100,000 psi., with excellent flexural strengths and impact resistance. Laminated parts have been made for a number of applications where good electrical resistance, low density, and high strength are desirable. Complex parts can be machined readily with water-cooled tools of tungsten carbide.

Laminated pipe

One application of fibrous glass-reinforced plastics in process work is in the recently announced Glasweld pipe and tubing. Glass cloth is laminated with polyester plastics in either a convolute (longitudinal) structure or a spirally wound tubing. The spiral design is favored for piping. Pipe in lengths up to 30 ft. is available in diameters from $\frac{1}{4}$ to 12 in.; threaded fittings are supplied in sizes from 1 to 6 in. The pipe has a bursting strength of 2,800 to 7,300 psi., depending on the design and the diameter; with screwed fittings the maximum recommended working pressure is 600 psi. The serviceable temperature range is -50 to 135 deg. C., or up to 220 deg. C. for short periods.

Glasweld is well suited to underground service, and resists erosion effectively. Its corrosion resistance, while not as good as that of



PIPE FITTINGS of glass cloth laminated with plastics are light and easy to handle. Specific gravity of Glasweld is only 1.8. Threading, however, must be done with carbide tools.

glass, is still very good. Hot concentrated H_2SO_4 and hot caustic destroy it pretty rapidly, but most other corrosives have little effect on it.

Most glass-plastic products on the market contain about 50 percent glass by weight and do not realize the full intrinsic strength of glass. New products are under development which promise to do a lot more. Materials containing up to 80 percent glass, with strengths up to 200,000 psi., have been reported. If and when they come on the market, glass will invade other new fields and solve many other problems.

Promise for the future

ACKNOWLEDGEMENT

The author is indebted to the manufacturers of glass and glass-covered equipment who supplied information and illustrations for this report. Thanks are due especially to J. R. Blizard and E. F. Kelm of Corning Glass Works and S. W. McCann of the Pfaufler Co. for their cooperation and assistance.

The following manufacturers supplied photographs: Page 117, Corning; page 120, Corning (a, b, d, e), Nash (c), Thermal Syndicate (f), General Electric (g); page 126, Pfaufler (a, b, f), Glascote (c, e, g), Vitreous Steel Products (d), A. O. Smith (h); page 129, Owens-Corning, U. S. Plywood.

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Editorial Viewpoints

A Sobering Supposition

Suppose the Communists were to cut us off from Southeast Asia's flow of raw materials. What if they were to overrun India or Western Europe? How seriously would we be affected? Certainly we'd feel the pinch on rubber, tin and tungsten from Burma, Malaya, Thailand and Indo-China. Loss of India's manganese, ilmenite, chromite, kyanite, mica, shellac and tea would at least temporarily disturb our economy. But, thanks to our better technology, the pain would be far less than that which Japan's conquests inflicted on us only ten short years ago.

We are now on our way to a million tons of synthetic rubber of far better quality than once was produced in but half that quantity. Our tin and tungsten stockpiles plus sound conservation methods could probably keep industry operating for at least a year in almost any emergency. Meanwhile, sweeping adjustments would have to be made in developing substitutes and new sources of supply for other strategics. But the record shows it can be done.

No Santa Claus

Drastic curtailment of student registrations is already having serious effect on chemical and engineering training. This is a bad thing for the students, for the colleges, and for the future of technology. There seems to be little most of us can do about it except to hope that the cutback will not be as great as now appears likely.

Not so, however, with Du Pont's chief engineer, Granville M. Read. He has made a concrete offer to provide stimulating technical employment for some of the professors not now needed for university work. He would give these men twelve months' experience throughout the Du Pont engineering organization, pay their salaries, plus reasonable expenses.

"This is no Santa Claus proposition," according to the very practical Mr. Read. "The specific details of how many professors will be chosen, where they are to come from, and when, have not yet been worked out. But industry has a profound interest and responsibility in contributing to the support of colleges and universities. This is a sincere and earnest offer of one practical way to a better understanding of our mutual interests."

All concerned could benefit from such a transaction. That is, unless the professors are weaned away from the campuses permanently, which would be most unfortunate. College budgets would be relieved at a time of financial stringency. Industry would gain

some new skills, certainly new viewpoints on its problems.

But most important of all would be the professional advancement and the industrial stimulus given to the faculty men. They would return to their college activities with new enthusiasm for and understanding of their contributions to the progress of our industries. Thanks, "Slim" Read, for your offer. We hope the plan works so well that others will try it.

Thinly-Veiled Plea for Public Power

"A Water Policy for the American People" is the first 450-page volume of the long-looked-for report of the President's Water Resources Policy Commission. Many features of the document commend themselves highly to any industrial or engineering executive interested in power development and industrial power utilization. But there are probably few in industry who will agree with its conclusions as to the essentiality of complete governmental control.

The distinguished chairman of the Commission, Dr. Morris L. Cooke, has for several decades been an outstanding advocate of greater governmental participation in power projects. In this report Dr. Cooke and his associates go the whole way toward allocation of major responsibility for power supply to the federal government.

Most disappointing to many readers will unquestionably be the fact that the report is essentially an argument for governmental control rather than an analysis of facts or an impartial interpretation of them. Nevertheless the report deserves careful study by every power-using enterprise. One can ignore the welfare philosophy which dominates and still find substantial guidance as to trends and problems, provided he does not become too impatient with the over-riding argument.

Chemical process industries are the largest users of industrial power in America. No other segment of the economy has as much to gain or lose from good or bad planning. Even though we do not expect the Commission program to be adopted at all soon, it will be very important to know of its meaning and to inform legislators as to the difference between sound economic and engineering planning and the dangerous philosophic distortion of governmental participation in everything affecting power.

Just now, despite all of our other public burdens, we must be sure that legislators do understand the proper contribution of government to the greater power supply which is urgently needed for defense. The law makers must also be helped to avoid the pit-

falls which will burden such essential power development through socialistic complications. Certainly it is in the public interest to contribute as much factual guidance as possible on any project so vital as a national water policy.

Research, too, Has Bottlenecks

Urgent demands by the military for new research and development projects are worrying many Washington administrators. There just doesn't seem to be enough research capacity to serve normal civilian needs and all the investigations now wanted by the Armed Forces. Pressure is building up for another OSRD. Some careless commentators even suggest that the National Science Foundation be diverted from its fundamental purpose in order to set up a new program for military and applied research. Thus, it is time to spot what may prove a serious bottleneck in national mobilization.

Dr. Eric A. Walker, executive secretary of the Research and Development Board of the Department of Defense, estimates that in the late 1930's this country's research capacity could use efficiently about \$300 million per year. Of that amount 10 percent was for military projects. At the end of World War II, the research capacity was adequate for \$1,300 million spending, of which 40 percent was military. In 1951 it appears that the country's research capacity does not now exceed \$1,750 million. Of this total, a goal of at least 60 percent (\$1,000 million) is needed for military projects, without allowing any increase in capacity for civilian work over what was in use six years ago. Obviously, we cannot stand still. Nor can we cut back all current civilian projects without seriously affecting the strength of war industries.

Biggest bottleneck in all research programs, of course, is the lack of scientific manpower rather than of dollars or new facilities. It will grow worse as the graduating classes from engineering schools drop from 50,000 in 1950 to barely half that number in 1952. In their own interest, RDB and other military agencies must give stronger support to plans for continuing the technical training of research scientists and engineers.

Overreaching for Synthetic Fuels

We wish we could share with Secretary Chapman in his optimism for synthetic fuels from coal. In an enthusiastic report to Congress on work completed last year by the Department of the Interior, he urges immediate consideration of one or more plants to produce synthetic liquid fuels by direct hydrogenation of coal. He even goes so far as to say that "establishing the initial plants would involve little financial risk to the government or to industry."

Admittedly, the Department's research has been of top-notch quality. The pilot plants have apparently

been well designed and operated. But the results we have seen to date have not yet convinced us of the feasibility of large-scale commercial operation—especially for liquid fuels. Right now, if it were practicable, the production of certain coal hydrocarbons, such as benzene, might seem much more profitable. Yet over the years it has been our observation that most projects for coal processing have failed because of inadequate markets for all of the inevitable coproducts and by-products of such operations. Congress would be better advised, in our opinion, to support continued research with more emphasis on market studies and the economic as well as technical feasibility of coal hydrogenation at this time.

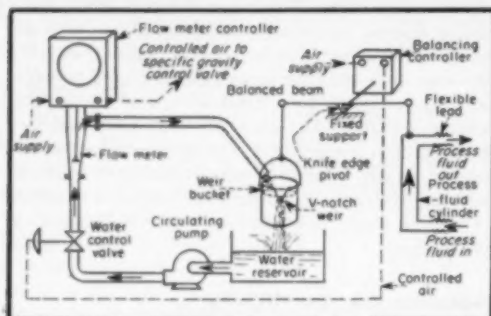
Sulphur for Fertilizers

Fertilizer manufacturers bitterly complain that they aren't getting enough sulphur and sulphuric acid to produce the fertilizer needed for 1951 crops. With total demand for sulphur, including export, expected to exceed supply in 1951 by more than 500,000 tons, and little likelihood of increasing the supply, the problem of distribution is exceedingly acute.

Pressure on Defense Mobilizer Charles E. Wilson to declare agriculture a defense industry, particularly so that it could get sulphur for fertilizer, is growing. After four days of blitz hearings, when Wilson refused to hold up an allocation order on sulphur until full hearings could be held, the fertilizer and farm machinery subcommittee of the House Agriculture Committee came out vigorously for giving defense status to all of agriculture. Its recommendation was promptly endorsed by Senator Allen J. Ellender, Louisiana Democrat and chairman of the Senate Committee on Agriculture and Forestry.

Congressmen also urge that Department of Agriculture officials be given jobs in policy-making defense agencies. The House subcommittee charges that NPA's Chemical Division has no policy directive to guide it in deciding between agricultural and industrial claimants for scarce sulphur. The Department of Agriculture, it's also charged, was not consulted in the drafting of a sulphur and sulphuric acid allocation order.

Meantime, other ways to meet the sulphur shortage are put forth by the House subcommittee. Among them: cutbacks in U. S. exports of sulphur; surveys to find if any present users are wasting sulphur and sulphuric acid that could be re-used; studies of sulphur and sulphuric acid sources by the government, with sulphur recovery required, where appropriate, as a condition for getting accelerated amortization or other government help on a facility; and intensified research into methods of producing fertilizer with less acid. Even while hungry defense plants bite into sulphur and sulphuric acid, the equally vital fertilizer industry cannot be crowded aside.



Improving Specific Gravity Control With a Fluid-Response System

JOHN F. SCHNACKY, Chemical Engineer and Manufacturers' Representative, Buffalo 22, N. Y.

★ February Contest Prize Winner

Controlling the specific gravity of viscous solutions, emulsions, paper stock slurries and the like has long been considered a difficult problem where accuracy must be attained, and full advantage taken of the possibilities of modern instrumentation. The "fluid-response" specific gravity controller diagrammed above accomplishes these ends and does so by making use of any standard flow meter controller. This controller is isolated from the specific gravity sensing device and yet may be calibrated in terms of the specific gravity of the process liquid. Its control output may be applied to a specific gravity controlling valve situated at any desired point in the process system.

The operating principle is simple. The process liquid flows through a specific gravity measuring cylinder suspended on one end of a balance beam. Liquid is conveyed to and from the gravity measuring cylinder through any suitable kind of flexible leads. Since the cylinder volume remains constant, changes in specific gravity will result in changes in weight of the cylinder contents. The cylinder is balanced at all times by the weight of water in a weir bucket suspended from the other end of the balance beam. How the weight of water is varied in response to gravity changes will be evident from the drawing and from the following explanation.

★ March Contest Prize Winner

"How to Use an Orifice Valve in Flow Measurement to Reduce Pressure Loss."

A prize of \$50 in cash will be awarded to James B. O'Hara, assistant professor of chemical engineering at Lehigh University, Bethlehem, Pa. The prize winning entry will appear in the May issue.

\$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of Chemical Engineering will award \$50 cash each

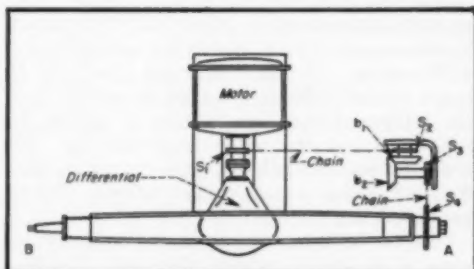
month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the April winner will be announced in May and his article published in June. Judges will be the editors of Chemical Engineering. Non-winning articles submitted for this contest will be published if acceptable at space rates.

HOW TO ENTER CONTEST—Any reader of Chemical Engineering, other

than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible.

Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries. Also, novel means of presenting useful data are acceptable. Address Plant Notebook Editor, Chemical Engineering, 330 West 42nd St., New York 18, N. Y.



How to Use a Differential Gear for Speed Reduction

OLAV FLATHEIM, Civil Engineer, Stavanger, Norway.

Sometimes it is necessary to drive a machine at an extremely slow speed. Ordinarily this would involve a

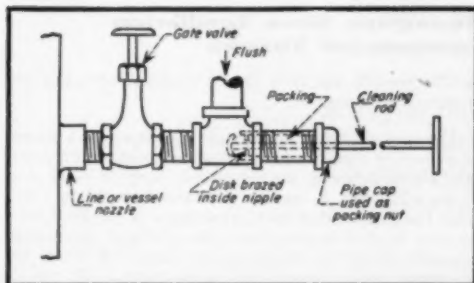
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complicated speed reducer, but there is a simple way of achieving very low output speeds that requires little in the way of investment. It consists in using an ordinary automobile rear-end gear system (usually obtainable second-hand) as a differential gear reducer.

The sketch indicates one way for setting up such a gear. In this case we wish to produce an output speed of one revolution in 18 min., from a 710-rpm. 25-cycle motor. The motor is connected direct to the differential drive shaft, with a power take-off from this shaft also driving one of the axles. The output of the unit is taken from the other axle. If not much power is needed, the drive for axle A can be constructed from light transmission chain and sprockets, such as those that are used on bicycles.

The principle is clear if it is considered that, when axle A is driven at twice the speed it would have if both axles were running free, then the speed of axle B will be zero. Hence, by driving A at a speed only slightly less than twice free speed, the speed of B can be made as small as desired. In this case, with 710 rpm. input and a pinion-bevel gear ratio for the differential of 9:41, the free running axle speed would be $710 \times 9/41 = 155.8537$ rpm. If now the sprockets have numbers of teeth as follows: $s_1 = 17$, $s_2 = 15$, $s_3 = 22$ and $s_4 = 52$ teeth; and if the two bevel gears have 20 teeth for b_1 and 22 teeth for b_2 , then the speed of A is $710 \times 17 \times 22 \times 20 / (52 \times 15 \times 22) = 309.4871$. To produce zero speed for B, the speed of A would have to be $2 \times 155.8537 = 311.7074$. Hence the speed of B will be $311.7074 - 309.4871 = 2.2203$ rpm. If we now put a 40:1 worm drive between B and the driven machine, the final speed will be $40/2.2203 = 18.01$ min. per revolution, or roughly, one revolution in 18 min., as the problem originally specified.



How to Clean Pressure Taps During Operation

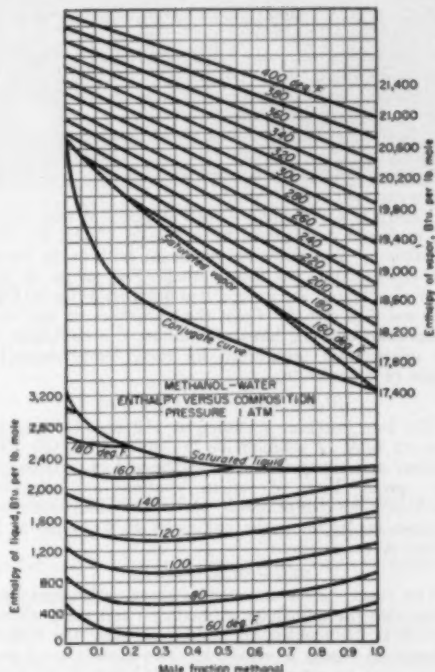
M. ISTRE and W. A. WILSON, Firestone Tire & Rubber Co., Lake Charles, La.

This simple arrangement permits cleaning pressure taps in lines or vessels without interrupting operations. It has been in use in a synthetic rubber plant to remove rubber obstructions from the pressure taps for a back pressure regulator on continuous polymerization lines.

The packing gland assembly was improvised from a nipple with a disk brazed in one end and a pipe cap on the other. Holes were drilled to accommodate the rod used. The long stuffing box permits free movement of the rod, since the packing need be compressed only moderately to prevent leakage. It also provides an adequate guide for the rod.

The cleaning rod with a hook as illustrated has been satisfactory for the purpose mentioned, with water used as the flushing medium. It is obvious that the same principle might be applied with slight modification by use of various shaped rods and various flushing materials. Steam, air or organic solvents might be used if compatible with the contents of the system. In stubborn cases a twist drill bit could be welded to the rod and a mechanical drill used to turn the rod.

In addition to pressure taps, other nozzles such as sampling points, feed or draw-offs, can be opened in a similar manner.



Enthalpy-Concentration Chart for Methanol-Water Solutions

L. S. ANSELL, H. SAMUELS and W. C. FRISHE,* Clarkson College of Technology, Potsdam, N. Y.

Methanol-water solutions are important industrially, hence complete, accurate, and readily available data on their thermodynamic properties are desirable. Calculations that involve distillation, concentration, and dilution of such systems are frequently necessary.

Calculations for the distillation of a binary system are

* Deceased.

NOMENCLATURE

- H_p = Enthalpy of pure water, Btu. per lb. mole.
- H_m = Enthalpy of pure methanol, Btu. per lb. mole.
- $(H_s)_t$ = Enthalpy of solution at t deg. F.
- H_{110} = Enthalpy of solution at 110 deg. F.
- x = Mole fraction of water.
- q_s = Integral heat of solution, Btu. per lb. mole.
- $(C_p)_s$ = Molal heat capacity of solution, Btu./lb. mole deg. F.
- Δt = Temperature difference, deg. F.

most commonly handled by the McCabe-Thiele method, based on the assumption of constant molal overflow, which is not quite true in the case of the system methanol-water. The method of Ponchon⁶ and Savarit⁷ takes into account the heat balance within the column as well as the material balances by the use of an enthalpy-concentration chart. Such a chart is also useful in performing calculations to determine the heat effects in processes in which there is a change in concentration.

The various methods of construction of enthalpy-concentration charts are described by McCabe⁸ and by Dodge.¹ The method to be used depends on the availability of accurate data and the convenience of the various methods. The following data for the methanol-water system are easily available and are believed to be sufficiently accurate:

1. Enthalpies of pure water⁹ and pure methanol,¹⁰ both in the liquid and vapor states.

2. Specific heats of various mixtures of methanol and water at various temperatures.⁹

3. Heats of solution of methanol and water at various temperatures.⁹

4. The liquid-vapor equilibrium data for the methanol-water system at 1 atm.⁹

Construction Procedure—The enthalpies of pure water and methanol are assumed to be zero at 32 deg. F. The enthalpies of pure water and methanol, both in the liquid and vapor states, are first plotted. The values of the heats of solution⁹ are interpolated graphically for 60, 80, 100, and 110 deg. F. From the enthalpies of the pure components and the heats of solution, the enthalpies of the solution are determined for these temperatures by means of the relation:

$$(H_s)_t = [xH_w + (1-x)H_m - q]_t$$

The base isotherm is chosen as 110 deg. F. since no data on heats of solution are available above this temperature and extrapolation is considered to be inaccurate. The specific heats of various solutions are integrated graphically for temperatures up to the saturation temperature to determine the enthalpies of the solutions by means of the relation:

$$(H_s)_t = (H_s)_{110} + (C_p)_s \Delta t$$

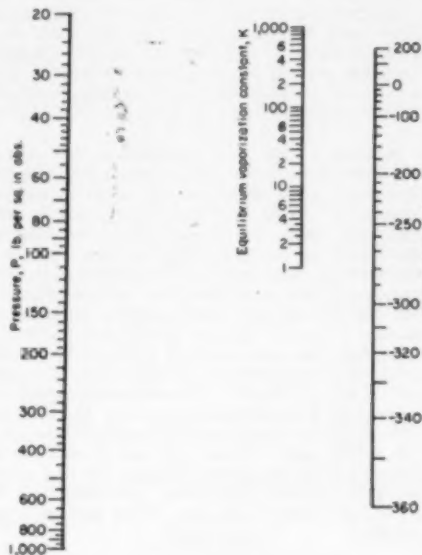
The vapor curves are readily drawn as straight lines connecting the enthalpies of methanol and water already plotted at the temperature concerned, since the heat of solution of vapors is negligible. The enthalpies of pure water must be extrapolated below 212 deg. F. to determine the enthalpies of the superheated vapor below 212 deg. F., and the enthalpies of the saturated vapor. The saturation temperature and the conjugate curve are found from the equilibrium data.⁹

Use of the Chart—As a typical example of use of the chart, consider the addition of 1 lb. mole of 80 mole percent methanol at 140 deg. F., to 1 lb. mole of water at 60 deg. F. What is the resulting temperature? The final composition will be 40 mole percent methanol. From the chart the enthalpy of the 80 mole percent methanol is 1,951 Btu. and of the water is 506 Btu. per lb. mole. The total enthalpy will be 1,951 + 506 = 2,457 Btu. and the enthalpy of the resulting solution will be 2,457/2 = 1,229 Btu. per lb. mole of 40 mole percent methanol. The temperature at which 40 mole percent methanol will have this enthalpy (from the chart) is 117 deg. F.

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Nomograph Gives Equilibrium Constants for Nitrogen

R. C. SCOTT, JR. and D. S. DAVIS, Virginia Polytechnic Institute, Blacksburg, Va.

The accompanying nomograph, developed as a means of estimating equilibrium vaporization constants for nitrogen, is applicable over the temperature range of -360 deg. F. to +200 deg. F. and for pressures from 20 to 1,000 psia. For systems that contain hydrogen or paraffin hydrocarbons, or their combinations, the calculated equilibrium constants should be multiplied by a factor of 1.2 to 1.5 or greater.

The chart is based on a relationship given by Brown and Stutzman¹:

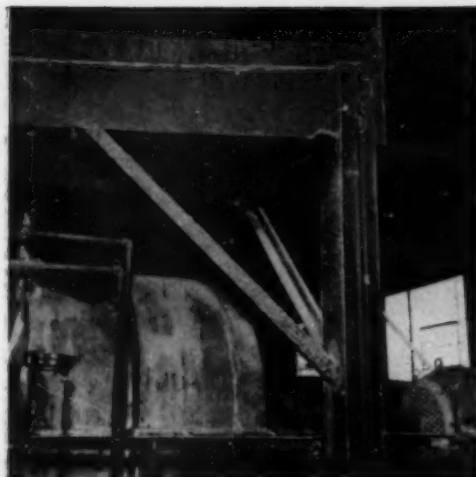
$$\log \frac{K P}{1 + 0.008(P/100)^{1.3}} = 4.930 - \frac{520.0}{T}$$

where K = equilibrium vaporization constant for nitrogen = y/x ; x = mole fraction of nitrogen in liquid; y = mole fraction of nitrogen in vapor; P = pressure, psia.; and T = temperature, deg. F. abs.

The use of the nomograph, constructed by methods described previously,² is illustrated as follows: What is the equilibrium vaporization constant for nitrogen at a pressure of 90 psia. and at a temperature of -200 deg. F.? Connect 90 on the P scale with -200 on the t scale and read the equilibrium vaporization constant as 9.5.

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DON'T HAND CLEAN or you may run into the kind of trouble shown here. Same coating and same area as photo on the left.

How to Protect Your Steel

Practical tips and fresh ideas from plant-scale tests
in highly corrosive atmospheres:

1. Dry sand blasting is the best surface preparation.
2. Unorthodox coatings fail rapidly.
3. Film porosity is more important than chemical resistance.
4. Electronic gage & 2-color system help get good coverage.
5. Drying time can be cut reducing chemical contamination.
6. Test panels are practically useless.
7. Ordinary house paints may be the most economical coating.
8. Thin edges and sharp corners must be kept to a minimum.

J. B. SCOTT

NOTE: Steel structures at the Adams Terminal Plant of the Phillips Chemical Co., Pasadena, Tex., do not have an easy life, for they are subject to a combination of severe atmospheric and chemical attack. The atmospheric environment is one of salt air, high average temperatures, and high humidity. The chemical environment: a multitude of fumes and dusts associated with the manufacture of ammo-

nium sulphate from anhydrous ammonia and sulphuric acid. Here is a summary to date of what Phillips Chemical has done and plans to do at its Adams Terminal Plant to lick the problem—together with some of their philosophy of small-scale testing, use of cheaper coatings, and design of steel structures from a corrosion standpoint.—EDITOR.

1. Dry sandblasting best

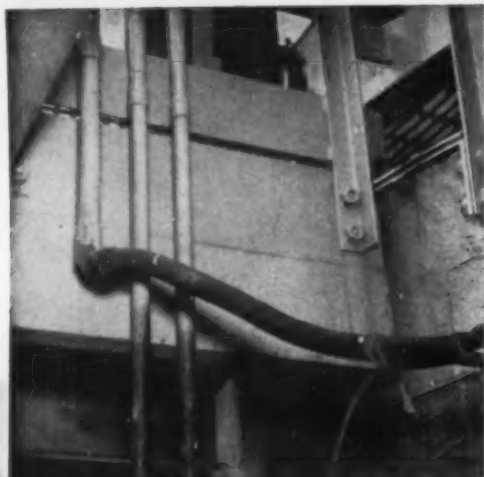
It has often been said that proper surface preparation is responsible for at least half the success of a coating system. With this in mind, many methods of surface preparation were tried to determine how far it is necessary to go.

Hand Cleaning—with scrapers and wire brushes, sometimes in conjunction with flame cleaning, was found insufficient for good results.

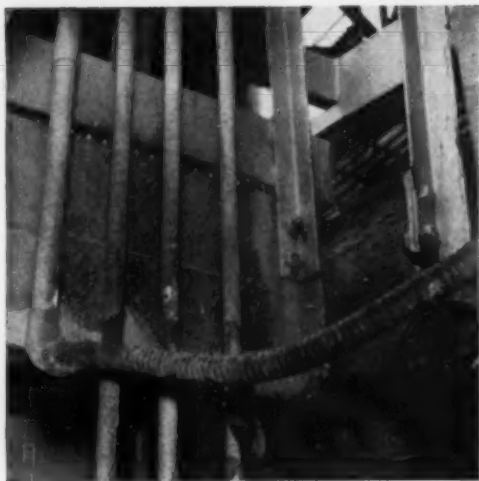
Wet Sandblasting—slow, expensive and unsatisfactory. After blasting and rinsing, a thin film of rust would form over the surface before it could be coated, although the water used for blasting and rinsing contained a rust inhibitor to the point where it irritated the skin of the workmen preparing the surface.

Dry Sandblasting—although relatively expensive, was most satisfactory. At first it was thought necessary to remove traces of ammonium sulphate remaining after blasting by washing with inhibited trisodium phosphate solution, rinsing with water contain-

J. B. SCOTT is superintendent and chief engineer of the Adams Terminal Plant of Phillips Chemical Co. This article is based on his paper presented before the annual meeting of the South Central Region, National Association of Corrosion Engineers, Houston, Oct. 9, 1950.



RECOAT RAPIDLY. Time between application of vinyl resin coats on these crystallizer structures was kept to a minimum.



DON'T DELAY. If the interval is too long, contamination will occur and coating will deteriorate rapidly as shown here.

ing an inhibitor, and flame drying. (An acetylene flame was more effective than a propane flame because of the smaller amount of water formed by combustion, but rust film was nevertheless encountered frequently.)

Further evaluation indicated that dry sandblasting alone gave a better surface, provided the blasted surface was coated within a matter of hours. Generally, specifications now require that all blasting be done on the day shift and on a dry day, cleaning only that area that can be coated in the same shift. In areas where sandblasting is prohibited, the most effective method is thorough hand cleaning followed by treatment with solutions containing phosphoric acid or a mixture of phosphoric and sulphuric acids. As before, the cleaned and treated areas must be coated during the same shift. This hand cleaning and chemical treatment is not as satisfactory as sandblasting, but appears to be the next best substitute.

2. Types of coatings

Many different types of coating materials have been tried, both singly and in combination. Unorthodox combinations, using basically different materials for successive coats, failed rapidly in all applications.

Phenolic—The conventional phenolic oleoresinous type was found satisfactory in areas where exposure is essentially atmospheric and chemical contamination is at a minimum. This type has the advantages of moderate cost, ease of application, and good film build per coat. It is easy to main-

tain, requiring only good hand cleaning of the failures prior to spot-priming and recoating. The service of this material in more severe areas has not been satisfactory.

Alkyd—Alkyd coatings have not in general proved suitable when exposed to ammonium sulphate. Their use is now limited to the ammonia storage tanks outside the operating area.

Asphalt and Coal Tar—Cut-backs of asphalt and coal tar have not been successful, primarily because of their low solids content and poor outside durability. Too many coats are required for proper film build, increasing the opportunity for chemical contamination between coats and subsequent rapid failure.

Gilsonite-Asphalt—One of the more satisfactory materials for use in the operating and bulk storage areas has been a gilsonite-asphalt mastic of the thick-coating type. This material has the great advantage of one-coat application, eliminating the possibility of contamination between coats. Poor resistance to abrasion is one of the deterrents to its more widespread use. In relatively dry areas, no primer is necessary over the sandblasted surface. Where occasional moisture is encountered, a phenolic primer has proved beneficial under the mastic coat. Where liquids are almost continually present because of dripping, splashing or spillage, this type of coating has not shown good service, with or without a primer. Failures in such areas generally start as small breaks on edges with corrosion continuing unnoticed under the film until a large patch of the coating peels or

drops off. This fault is not limited to the mastic, however. No coating tried has been successful under these particular conditions.

Vinyl—Vinyl coatings have been successful for certain purposes. They require exceptionally good surface preparation for satisfactory adhesion, and numerous coats are needed for suitable film thickness. These requirements hinder the use of vinyls in the operating area where proper surface preparation is difficult at best, and between-coat contamination occurs rapidly. Good results have been obtained with vinyls, however, on mobile material-handling equipment and vehicles, where the equipment can be removed from the operating area and dismantled, cleaned, coated and reassembled without fear of contamination. As with the gilsonite-asphalt mastics, vinyls have shown poor durability in wet chemical areas, failing primarily by under-film corrosion and peeling.

One new and special form of vinyl coating, a thick-coating mastic type using chemical resistant pigments and fillers in a typical vinyl vehicle, is showing considerable promise in current tests. This material requires careful surface preparation and a primer as for conventional vinyl coatings, but so far has shown excellent adhesion and resistance to abrasion and moisture penetration, especially when sealed with two coats of conventional vinyl top coat. Since this material can be applied in one coat if necessary, it may eliminate the objections to the use of vinyls where corrosive liquids are prevalent.



RIVETS and joints between riveted plates promote bridging of the coating.

Specialties—A few specialty items have been used in limited areas or are showing good results in current tests. Glass fabric reinforcement imbedded in thick mastic films has materially increased the resistance of such films to abrasion and has permitted the building up of thicker and more impervious films on sharp corners and thin edges where failure is first likely to occur. Caulking compounds in rope form and containing fillers inert to ammonium sulphate have been useful in sealing joints, crevices, and small areas inaccessible for proper cleaning and coating. The use of these and similar materials, however, must be limited to the more critical areas because of their cost. The slow and laborious application by hand precludes their more general use.

3. Effect of Porosity

At the inception of the protective coating program at Adams Terminal, it was thought that the chemical resistance of the coating film itself was the most important factor in the success or failure of a coating material once the surface was properly prepared. Later experience derived from relatively large scale applications on equipment and supporting structures proved that this factor was a secondary one. Of more importance was the porosity of the applied film.

The rapidity of failure of applied films of the same materials appeared to be roughly proportional to the degree of porosity. Materials with good inherent chemical resistance but having a higher porosity of the applied

film gave poorer performance than materials of lesser resistance but with a greater degree of impermeability. It was found necessary to use total film thickness as a criterion of proper application rather than merely the number of coats without consideration for the solids content of the coating material or the personal factor in application technique.

4. Optimum coverage

Optimum film thickness naturally varies with the material being used. This thickness has been found to be 5-6 mils for vinyl, phenolic and alkyd coatings, and 60-75 mils for the gilsonite-asphalt mastic. For the vinyl mastic currently being evaluated, 30-35 mils thickness seems to be satisfactory. Thicknesses below these optimum values apparently are responsible for a disproportionate decrease in durability, while film thicknesses in excess of those given have not shown so far an economic payout in increased service life.

Electronic Gage—A portable film thickness gage of the electronic type has proved invaluable in this work. It has been used not only to determine experimentally the proper film thickness for optimum economic durability but also as a routine procedure to insure proper application in the field and in the developing of proper technique by the painters. The cost of such an instrument is less than 1 percent of the annual cost of even a modest protective coating program. However, it can easily be the difference between the success of such a program and a possible reduction in the annual cost or failure through increased cost due to improper application.

Different Colors—Another aid in obtaining proper coverage has been the use of different colors for successive coats. Gray and black, for example, when alternated provide sufficient contrast to insure uniform coverage and suitable film thickness for each individual coat. Where it is not desirable or convenient to keep in stock two colors of the same material for a specific application, it is usually possible to tint half the material with a small amount of a similar and compatible material in a strongly contrasting color. As an example, one pint of red phenolic primer in five gallons of a gray phenolic top coat will produce an orchid tint.

5. Drying time can be cut

A major factor is the drying time of the protective coating. This is es-

pecially important in areas where chemical contamination is prevalent. Slow drying materials obviously expose the surface to greater contamination between coats. This increases the possibility of split-coating, or poor adhesion between successive coats with eventual separation and peeling. Under-film corrosion is also more likely because of easier penetration of the incomplete and thus more porous coating.

Where it is desired to use relatively slow-drying materials in areas where contamination is possible or when time is limited, use of the so-called rapid-recoat system has been of value. According to this system the second coat is applied as soon as the solvent has evaporated from the first coat and the material has set up, but before any appreciable oxidation and polymerization has taken place. Succeeding coats are applied in the same manner. In this way the desired final thickness may be obtained in a much shorter time with considerably less danger of between-coat contamination.

6. Small-scale testing

In an effort to evaluate as many of the more promising protective coating materials and methods as possible, a small-scale testing program has been established. This program is strictly practical in nature, attempting to duplicate on a small scale the conditions of surface preparation and application that are encountered in the plant on a large scale.

Test Panels—The preparation and exposure of test panels has been eliminated entirely. Panels usually get better surface preparation than any plant structures, and they do not have the comparable type of thin edges and sharp corners. Many materials showing good durability on panel exposure tests fail rapidly when used under more realistic conditions.

Angle Iron Sections—In contrast, short sections of angle iron more nearly duplicate plant structural shapes and are more easily given similar surface preparation and coating. Prepared sections using methods and materials to be evaluated can be fastened to equipment or structures and exposed to the desired conditions, along with sections duplicating applications of known durability for comparison. However, at best such comparisons serve only as a screening process to eliminate the more unsuitable materials and procedures. Final evaluation can be made only after actual application over a reasonable area in the plant.

7. Use of cheaper coatings

The entire protective coatings program to date at Adams Terminal has been based on the theory that the best materials available applied to surfaces given the best possible cleaning will prove to be the most economical over a period of time. However, because of the severe conditions encountered and the relatively poor service obtained so far from even the best coatings used, two other ideas have recently been proposed.

No Protection—The first is that no effort should be made to protect the steelwork in the more corrosive areas, and that such steel be replaced as required. This is not wholly a new idea. It has been the accepted practice in certain plants for many years, notably in the coke-oven byproduct recovery areas of some of the larger steel plants. In view of the steadily increasing cost of steel and labor, however, this proposal has less economic merit now than in the past. The decreasing availability of steel at the present time due to diversion to military uses is unfavorable.

Hand Cleaning and House Paints—The second idea is that sandblasting should not be used and that surface

preparation be limited to the best cleaning possible by hand methods. In addition, relatively low-cost coatings should be used. Dark-colored house paints and pigmented asphalts are among those suggested. The thinking behind this proposal is that while sand-blasting and the more resistant coatings admittedly will give longer service per application, the use of poorer preparation and materials will cost so much less per application that the annual cost of satisfactory protection will be reduced despite the increased number of applications required. This proposal is a radical departure from the doctrine built up by the experiences of protective coating manufacturers and consumers over many years. This idea was advanced by one of the largest manufacturers of protective coatings in the country. At the present time work to determine the merit of this proposal is barely under way. It will be interesting to examine the results when the evaluation has been completed.

8. Thin edges

Control of corrosion by means of protective coatings should begin on the drafting board, with special attention being given to the mechanical

details which will simplify the application and maintenance of protective coatings. In general, thin edges and sharp corners should be kept to a minimum, for it is here that coating failures most often begin.

Specific precautions include:

1. Use of welded in place of riveted joints where possible. Rivet heads add to the problem of proper surface preparation. They promote bridging of the coating between rivets and plates, leaving an area of poor adhesion and potential rapid failure.

2. Use of bracing members made from angle irons back to back separated by spacer plates should be minimized. The sides of the slots thus formed are virtually impossible to prepare and coat properly.

3. Cylindrical columns are much easier to prepare and paint than angle iron, channel or I-beam columns, and offer no sharp-radius curves or thin edges to induce bridging and crawling.

4. Complicated gratings with their relatively inaccessible surfaces and numerous edges are more difficult to prepare, coat and maintain than the upset-type non-skid floor plates.

5. Railings of tubular rather than the angle and strap type offer additional simplification of the problem.

Latent Heats of Vaporization Nomograph

Quickly finds the answers, eliminating time-consuming calculations. For finding heats of vaporization both at, and above, the normal boiling temperature.

THOMAS H. ARNOLD, JR., and PAUL K. RAIFORD

Chemical engineering process calculations frequently require the use of the latent heats of vaporization for various substances. In many cases these data are not available. Thus, it becomes necessary to calculate or estimate the required values by the use of empirical relationships, and several time-consuming methods for doing this have been proposed (refs. 1-4).

This nomograph reduces the time required. It gives heats of vaporization at temperatures greater than the normal boiling point as an added feature.

DEVELOPMENT OF THE NOMOGRAPH

The equation solved by the nomograph involves the following equations:

Empirical equation⁴ (T_b in deg. K.):

$$\Delta H_v = 0.95 AB \left(\frac{T_b}{T_b - 43} \right)^2 \quad (1)$$

TOM ARNOLD is a senior in chemical engineering at LSU, and is the author of two published nomographs for petroleum refining calculations. Paul Raiford is a chemical engineer with the International Paper Co., Springhill, La.

Calingaert-Davis equation¹ (T in deg. K.):

$$\ln P = A - \frac{B}{T - 43} \quad (2)$$

By applying Eq. (2) at the critical and boiling points, the constant B is determined:

(T_b, T_c , in deg. K.):

$$B = \frac{\ln \frac{P_c}{P_b}}{\frac{1}{T_b - 43} - \frac{1}{T_c - 43}} \quad (3)$$

Proper substitution and simplification of Eqs. (1) and (3) yields the expression:

$$\frac{\Delta H_v}{T_c} = \frac{0.95 A(T_b)^2}{(1 - T_b)} \left(\frac{T_c - 43}{T_b - 43} \right) \ln \frac{1}{P_b} \quad (4)$$

Upon conversion from absolute to engineering temperature units, the equations obtained are:

(t_b, t_c in deg. C.):

$$\frac{\Delta H_v}{T_c} = \frac{0.95 A(T_b)^2}{(1 - T_b)} \left(\frac{t_c + 230}{t_b + 230} \right) \ln \frac{1}{P_b} \quad (5)$$

(t_b, t_c in deg. F.):

$$\frac{\Delta H_v}{T_c} = \frac{0.95 R(T_R)^2}{(1-T_R)} \left(\frac{t_c + 382.6}{t_b + 382.6} \right)^n \frac{1}{P_R} \quad (6)$$

The relation* for calculation of heats of vaporization at temperatures greater than the normal boiling point is:

$$\left(\frac{\Delta H_v}{T_c} \right)_t = \left(\frac{\Delta H_v}{T_c} \right)_b \left(\frac{1-T_R}{1-T_{Rb}} \right)^{0.58} \quad (7)$$

The nomograph presented here solves Eqs. (5), (6), and (7). Eq. (5) and (6) should be used only for vapor pressures of 1 atm. and lower. Above this pressure Eq. (7) must be employed. Use of the actual compressibility factor, z , for the vapor in some cases yields more accurate results than the use of the average value of 0.95. Thus, for substances whose vapors deviate greatly from the perfect gas law, the latent heat of vaporization as determined by use of the nomograph may be corrected by multiplying by $(z/0.95)$.

COMPARISON OF METHODS

All values below are for pressures of 1.0 atm., except where noted otherwise. Values for these exceptions were

determined on the nomograph* by means of the pivot line from the values given at 1.0 atm.

Substance	$\Delta H_v/T_c$ Values			
	Meissner	Klein	Experimental	Nomograph
Acetone.....	13.7	13.5	14.25	14.1
Benzene.....	12.8	12.4	13.1	13.0
Benzene at 7.25 atm.....	9.3	9.22	9.51	9.55
n-Butane at 6.3 atm.....	10.3	10.1	10.4	10.75
n-Butyl alcohol.....	18.7	17.1	17.5	17.2
Chlorobenzene.....	13.0	12.8	13.8	13.23
m-Cresol.....	15.6	15.0	15.5	15.2
Cyclohexane.....	12.7	12.4	13.1	13.1
Diethylamine.....	13.4	13.2	13.4	13.8
Ethyl alcohol at 1.000 atm.....	19.0	18.9	19.1	19.5
Ethyl ether.....	13.4	13.1	13.3	13.8
Methyl alcohol.....	16.3	16.2	16.4	16.5
Methyl aniline.....	15.1	15.0	14.6	15.2
Methyl formate.....	13.4	13.1	13.8	13.7
Nitrogen tetroxide.....	19.7	19.4	19.1	19.7
n-Octane.....	14.3	14.0	14.2	14.5
Pyridine.....	14.2	13.2	13.8	13.6
Toluene.....	13.2	12.9	13.4	13.3

* Figures in the nomograph column of the above table were taken from a 9x7 in. nomograph.

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2. Klein, V. A., *Chem. Eng. Progress*, **45**, 675 (1949).
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Nomenclature

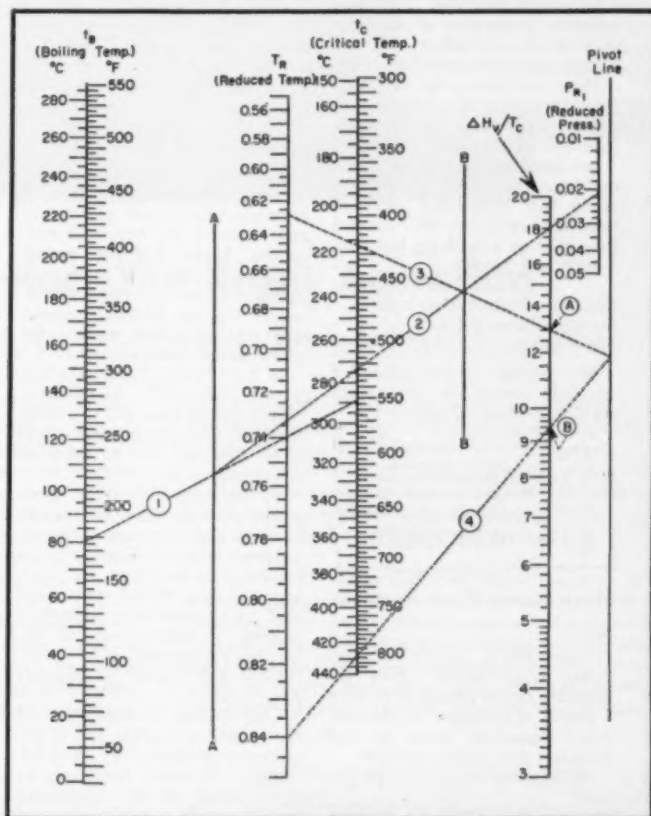
- ΔH_v = Molal latent heat of vaporization.
 T_c = Absolute critical temperature, deg. K. or deg. R., dependent upon units desired for ΔH_v .
 $\Delta H_v/T_c$ = Molal latent heat of vaporization divided by critical temperature, Btu./lb.-mol./deg. R. or cal./gm.-mol./deg. K., dependent upon temperature units used.
 R = Gas constant, 1.987 Btu./lb.-mol./deg. R. or cal./gm.-mol./deg. K.
 B, A = Callingaert-Davis vapor pressure equation constants.
 T_b = Absolute boiling temperature, deg. K., at pressure P .
 T_R = Reduced temperature, T/T_c .
 P = Vapor pressure of substance, atm.
 P_c = Critical pressure, atm.
 P_R = Reduced pressure, P/P_c .
 t_b = boiling temperature, deg. C. or deg. F., at pressure equal to or less than 1 atm.
 t_c = Critical temperature, deg. C. or deg. F.

Example

Calculate the value of $\Delta H_v/T_c$ for benzene at its normal boiling point, and also at a temperature of 200 deg. C.

- Normal boiling point
 = 80.2 deg. C. = 353.2 deg. K.
 Critical temperature
 = 288.5 deg. C. = 561.5 deg. K.
 Critical pressure
 = 47.7 atm.
 $T_{R1} = 353.2/561.5 = 0.628$
 $P_R = 1.0/47.7 = 0.02095$
 $T_{R2} = 473/561.5 = 0.8405$

(1) Connect 80.2 deg. C. on t_b scale with 288.5 deg. C. on t_c scale. Mark point of intersection with A scale.
 (2) Connect this point with 0.02095 on P_R scale, marking the point of intersection with the B scale. (3) Finally,



connect this point with 0.628 on T_R scale and read $\Delta H_v/T_c = 13.0$ (Point A) for benzene at its normal boiling point.

Connect 13.0 on $\Delta H_v/T_c$ scale with

0.628 on T_R scale and mark point of intersection with pivot line. (4) Finally, connect this point with 0.8405 on T_R scale and read $\Delta H_v/T_c = 9.4$ (Point B) for benzene at 200 deg. C.

Readers' Views & Comments

Oronite and Isophthalic

Sir:

Was pleased to see you devoting a little space to a subject dear to our hearts—chemistry of the xylenes (Feb., p. 305).

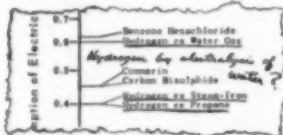
Oronite has long been active in the xylene field . . . offering for sale in commercial quantities the ortho and para isomers. We are now offering the meta isomer in limited quantities for research and development purposes. We have somewhat more than an academic interest in derivatives of the xylenes, including isophthalic acid.

Hence we question the statement (p. 308) . . . "Isophthalic acid will be available in the future at industrial grade xylene prices."

Are we culpably ignorant of the economic facts of life—or did you imply that prospective users of isophthalic acid may look forward to a price of something less than 5 cents per pound?

R. I. STIRTON
Manager, Product Development
Oronite Chemical Co.
San Francisco

We implied it—but damned if we really meant it! The figure should be about 20 cents.—Ed.



More Facts, More Factors

Sirs:

Your March article "Process Power Requirements" gives the electrical energy needed to produce a pound of hydrogen by the propane, steam-iron, water gas and ammonia dissociation processes . . .

What about the electrolytic process?

C. W. D. NIELSEN
Consultant
Los Angeles

Answer is 30 kwh. per lb.—14 in. off the page.—Ed.

Sir:

So far I haven't seen a good compilation . . . on the unit cost of different chemical and petroleum plants. Although the price of these will change, the data would be very helpful to practicing chemical engineers . . . if compiled on the basis of a certain date.

JU CHIN CHU
Dept. of Chemical Engineering
Polytechnic Institute of Brooklyn
Brooklyn, N. Y.

Dr. Chu's letter came as Editor Chilton was assembling data for just such a chart on plant costs. Publication date: next month in CE.—Ed.

Sir:

You are to be congratulated for your efforts in behalf of chemical engineers who prepare preliminary cost estimates and economic evaluations. Henry Eckhardt's appeal (CE, Sept. 1946) for articles on equipment and operating costs received staunch editorial support with the result that several very useful articles have appeared.

In his "Process Labor Requirements" (Feb. 1951), Mr. Chilton offers a simple chart and . . . states clearly its limitations, cautions that it be used only for an order of magnitude value.

To estimate labor for a given process it is necessary to visualize both size and complexity of the operations. The size factor . . . is handled by stating that the values apply to the "typical commercial size" for the particular product or process. It presupposes that the user has a knowledge of what constitutes the typical commercial size . . .

Only clue to the complexity of the operations is in the title of the process or product . . . Thus the chart, in its simple form, may be most useful to the experienced estimator with a good background in chemical technology. The casual user may be misled if he doesn't take the author's advice and make a check analysis . . .

Production rate and a thumb-nail description of each process would help the inexperienced estimator. A breakdown of each process into unit processes and unit operations (and the number of times they are used) might constitute a good basis for visualizing complexity of the operations.

To furnish a portion or all of this background material would require a great deal of work and probably more information than the author has access to. If Mr. Eckhardt's original suggestion could be adopted, your readers would furnish information . . . and Chemical Engineering would act as the clearing house. This would increase authenticity for the values and add to the number of processes listed. The arrangement suggested by Mr. Eckhardt could result in the development of a great deal of sound data on operating costs to the advantage of all.

Your editors have made a very good start on a difficult job. It is my hope that they will receive all the cooperation and help they need.

E. C. DYBDAL

Central Research Dept.
Monsanto Chemical Co.
Dayton, Ohio

We're happy to report to Mr Dybdal that (1) most of the data for the March chart on electrical energy and the one in this issue on utility requirements did come direct from industry; (2) he is cordially invited—and so are you—to author one or more articles in our cost and estimating series.—Ed.

Sir:

I would like to comment on the operating cost charts in your recent issues. . . .

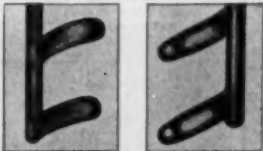
Merits: (1) Any effort to provide engineers with more tools and better tools is worthwhile. The need has been particularly great in the fields of costs and markets. (2) The broad scope of operations covered is commendable and so is the compact, con- (Continued on p. 196)



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adjustable baffles to obtain various degrees of turbulence. The combination is ideal for fluid mixes, gas absorption and for dissolving solids rapidly.

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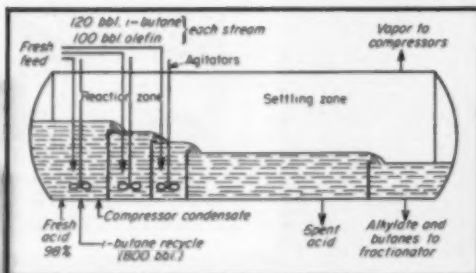
Edited by Cecil H. Chilton

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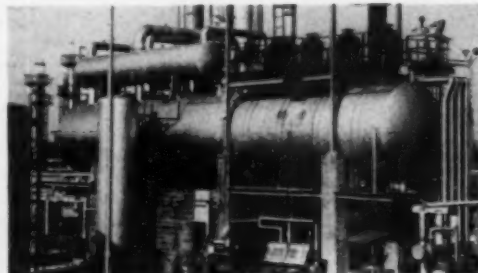
MORE INFORMATION . . .

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PROCESSING



COMPARTMENTS in this alkylation reactor define three separate reaction zones. Note how feed and recycle streams are introduced to maintain a high ratio of isobutane to olefin.



REACTOR is easily identified in this photo by the protuberances above the drum. These, of course, are the vertical motors which drive the individual agitators in the compartments.

New Reactor Uses Compartmented Design

Chemical engineers will profit by a study of Kellogg's approach to alkylation reactor design problem.

(142A) Rare indeed is the engineering development in any one of the process industries in which chemical engineers in other industries can afford to show no interest. A new alkylation unit designed by the M. W. Kellogg Co. is no exception. The heart of this unit, the reactor pictured above, although designed with the particular requirements of the alkylation process in mind, could easily be adapted to many other chemical processes operating under similar conditions.

Alkylation processes figured prominently in the World War II aviation gasoline program. The present international crisis, along with the prospect of still higher compression automobile engines, have renewed the petroleum refiner's interest in alkylation as a means of obtaining fuels of higher octane rating than are available from more conventional units. Improvements in processes and equip-

ment can logically be expected as more chemical engineering efforts are exerted in this direction.

In the familiar sulphuric acid alkylation process, light refinery gases, high in octane rating but too volatile for inclusion in gasoline, are combined into a high-octane liquid product boiling within the gasoline range. This product can be added in any proportion to refinery gasoline to improve its octane rating.

The liquefied gases are introduced into a reaction chamber in the presence of 98 percent sulphuric acid, which acts as a catalyst. During the reaction, which generally proceeds at a temperature between 38 and 40 deg. F., the acid drops in concentration because of dilution by moisture in the feed and side reactions with impurities. The spent acid is continuously withdrawn. Fresh acid is regularly introduced to keep the quantity and concentration of acid in the reactor constant. The product of the reaction is passed through a caustic wash and then fractionated at higher temperatures.

Spent acid has customarily been withdrawn at a concentration of

about 90 percent. The higher the concentration of the spent acid, of course, the greater is the net consumption of acid. Recent commercial tests have indicated the possibility of stable operation and acceptable yields with a spent acid strength as low as 85 percent, operating under carefully controlled conditions. It is true, however, that quality and quantity of alkylate suffer to some degree because of the lower acid strength. Optimum acid strength, therefore, is a matter of economic balance.

The Kellogg alkylation reactor is designed with these process requirements in mind. The reactor drum is divided into compartments by means of vertical baffles. Fresh acid is charged to the first section and flows through the other two sections before entering the settling portion of the reactor. Since the reaction is quite rapid, it is essentially completed in the reaction sections while the acid is still relatively high in concentration. For example, if it is planned to feed 98 percent acid and to withdraw 88 percent acid, then the average acid concentration in the three sections will be 91.5 percent, a relatively high

concentration which results in better quality alkylate.

The reaction proceeds more favorably when a high ratio of isobutane to olefin is maintained in the reaction zone. The Kellogg reactor design provides for approximately a 9:1 ratio in the reaction zone, despite the fact that the ratio as fed to the reactor as a whole is less than 4:1. How this is accomplished can be discerned by studying the material balance indicated in the sketch. The feed is split into three streams and fed to each separate compartment, while the recycle isobutane is fed into the first compartment only. Thus high ratios and concentrations of isobutane are maintained in the important reaction zones, although the total volume of isobutane in circulation is relatively low. Pumping and vessel costs are less than would be required to maintain the desired high ratio otherwise.

If you have read this far and have studied the sketch, you have probably already begun to consider potential applications of these principles to your own existing or proposed processes. No doubt you have thought of variations on this theme which will give you better control of concentrations and ratios in processes having nothing to do with high-octane gasoline. Progress in chemical engineering often occurs just that way.

Two other features of the Kellogg design are somewhat more limited in their application to unrelated processes, but represent improvements over other alkylation reactors. Kellogg decided that propeller-type agitators could be efficiently used here, inasmuch as intense agitating action can be confined to each small compartment and excluded from the large, quiet settling zone. These agitators operate at about 600 rpm. Former alkylation reactors used jet mixers to obtain the necessary mixing. Savings in horsepower amount to more than 75 percent, it is reported.

The final improvement is the use of auto-refrigeration to control reactor temperature. Since the reactor operates with a vapor space, heat of reaction can be removed by vaporization. To permit continuous vaporization, a portion of the vapor is withdrawn from the top of the reactor, compressed, condensed, and returned to the reactor. The investment cost for this system is said to be much lower than for outside refrigeration cooling systems.

Alkylation reactors are made of carbon steel. Alloy or lined construction should be entirely practical, if economically justified, when considering this reactor for other services.

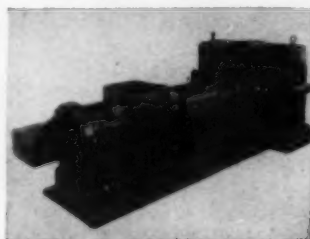


GOES AROUND IN CIRCLES:
Gyratory Sifter

(143A) Another new Allis-Chalmers gyratory sifter, different from the one described in this department in March, features a balanced, self-contained driving mechanism and quick, easy method of sieve assembly. This machine, designed for sifting dry, free-flowing granular products, is constructed completely of metal. The magnesium sieves can be provided with either metal or cloth screens.

The Circle sifter operates with a gyratory motion which causes all parts of the sieves to move in identical 14-in. to 24-in. circles, thus achieving uniformity of action throughout the entire sifting area. It employs a stack of three, four, or five sieves, the number used depending upon product sifted, required capacity, and screen mesh used. Operating speed can be changed to suit the product being sifted by changing the pitch diameter of the motor sheave in the Texrope drive.

Outside dimensions are 26½ in. square by 35½ in. high when using three sieves, up to 42 in. high when using five sieves. The sifter weighs approximately 400 lb.



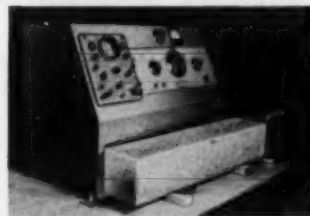
THRIVE ON JAW-BREAKERS:
Continuous Masticators

(143B) Watson Machine Co.'s continuous masticators are finding applications in such heavy-duty services

as the compounding of plastics, rubber, and floor covering mixes. They are also being used for such chemical operations as pasting manganese compounds with sulphuric acid.

The machine illustrated has a rated capacity of 2,000 to 8,000 lb. per hr. when using a 75 or 100 hp. drive. Larger machines go up to 24,000 lb. per hr. capacity and 300 hp. A smaller model for laboratory and experimental work is also available. These machines are jacketed for heating or cooling, as required.

INSTRUMENTS



MEASURES YOUNG'S MODULUS:
Frequency Meter

(143C) The new Electro Sonometer, developed by Electro Products Laboratories from Portland Cement Assn.'s basic design, is used for determining Young's modulus of elasticity for such materials as carbon, ceramics, concrete, plastics, steel, and aluminum.

The instrument consists of two units: a control cabinet and a portable pick-up. The control cabinet contains an amplifier supplying 18 watts of
(Continued)

Marshall and Stevens Indexes of Comparative Equipment Costs

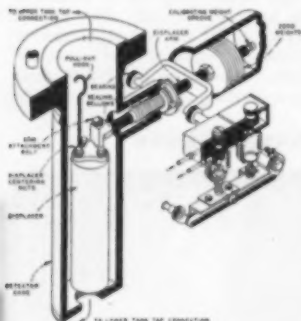
(1926 = 100)

Compiled quarterly for March, June, September, and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, *Chemical Engineering*, Nov. 1947, pp. 124-6. For a listing of annual averages since 1918 see *Chemical Engineering*, Feb. 1951, p. 158.

Industry	Mar. 1950	Dec. 1950	Mar. 1951
Average of all.....	160.0	177.1	181.2
Process Industries			
Cement mfg.	155.5	169.5	174.9
Chemical	163.5	177.5	182.0
Clay products	150.5	164.5	169.0
Glass mfg.	153.6	167.6	172.1
Paint mfg.	156.8	170.8	175.3
Paper mfg.	157.1	171.1	175.6
Petroleum ind.	159.9	172.9	178.4
Rubber ind.	162.3	176.3	180.8
Process ind. avg.	160.9	174.9	179.4
Related Industries			
Elec. power equip.	165.1	179.1	183.6
Mining, milling	164.2	178.2	182.7
Refrigerating	174.8	195.8	201.0
Steam power	162.2	166.7	171.2

NEW EQUIPMENT, cont.

power, which permits measurement of resonance frequency, with a good degree of accuracy, in solid masses weighing up to 1,500 lb. An accurate oscillator measures resonant frequency from 20 cycles to 22 kc.



USES A BALANCING BELLOWS:

Level Detector

(144A) Minneapolis-Honeywell has developed a new displacement type level detector, which, it is claimed, will detect the very smallest changes in liquid levels. This instrument basically comprises two sections—a detector unit and a force balance transmitter. A welded steel detector cage is connected to the vessel in which the level is being measured. The displacer is normally made of stainless steel, although brass, Monel, or plated displacers are available.

An increase in liquid level in the detector cage increases the buoyancy of the displacer and causes momentary displacement in an upward direction. This movement is transmitted through appropriately designed levers which are arranged to permit compressed air to enter a balancing bellows. The increased pressure in the bellows will cause the displacer to return to its original position. The change in level is indicated by the force required to maintain this position.

The minimum level range available is 14 in. and the maximum is 120 in., with pressure ratings of 300 and 600 psi.

FOR PRECISION MEASUREMENTS:

Differential Pressure Gage

(144B) Scientific Glass Apparatus Co. announces improvements in the Zimmerli gage for precise vacuum or differential pressure measurements. This gage is claimed to be accurate within 0.1 mm. Hg.. A desirable feature claimed for this model is that it

eliminates the necessity of boiling the mercury in order to remove air. Another is the large size indicating and reference limbs. The range is 0 to 100 mm.

DETERMINES AVERAGE TEMPERATURE:

Resistance Thermometer

(144C) A new resistance thermometer, designed primarily for determining the average temperature of petroleum, chemicals, and other liquids in large storage tanks, is the result of more than three years of research and development conducted by Weston Electrical Instrument Corp. in cooperation with Standard Oil Development Co.

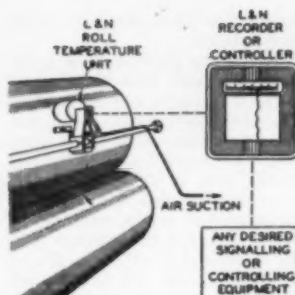
Inasmuch as petroleum products are moved on a volume basis, it is necessary that this volume be corrected to 60 deg. F. for standard accounting and billing purposes. Since the storage temperature is not controlled at any particular value, accurate average temperature before and after transfer must be determined. The best method hitherto available involved taking readings with oil cup thermometers at one or more specified locations in the tank. From 20 min. to 2 hrs. was normally required for this job.

The new thermometer consists of a flexible resistance bulb assembly, a meter, and an oil level selector, with the meter and selector enclosed in a housing for protection, while the bulb assembly is placed permanently inside the tank. This type of assembly permits the obtaining of an average temperature accurate to within $\frac{1}{2}$ deg. F. through a vertical column of oil in one reading in a few seconds. The assembly operates on 6 volts d.c.



CO₂ INDICATOR

(144D) Complete test for CO₂ in 20 sec. is claimed by F. W. Dwyer Mfg. Co. for this new transparent indicator. Body of the unit is made of solid Lucite, making it practically unbreakable.



MAKES NO CONTACT:

Surface Thermometer

(144E) A new surface temperature unit developed by Leeds & Northrup measures temperature of a moving surface without touching it. Because of this feature, it cannot scratch, score, or in any way destroy delicate surface films. Temperature detected by the unit is recorded by either a Micromax or Speedomax supplied as an integral part of the complete equipment. The recorder can be equipped to operate signals or controls.

The new instrument works on the principle that a moving object carries with it a thin, closely adherent layer of air nearly the same temperature as the moving surface. Mounted 1/32 in. from the surface is a measuring head, contoured to fit the surface if it is curved. A continuous stream of air is run past the measuring element and heats it to virtually the same temperature as the moving surface. Although recorded temperature is a few degrees lower than the true surface temperature, the difference remains substantially constant and is therefore negligible for process control applications. The difference is usually less than 4 deg. F.

Air suction rate and surface speed are not critical over a wide range. Measurements are not appreciably affected by ambient temperature. The unit also operates independent of the emission characteristics and finish of the surface.

FOR VERSATILE APPLICATIONS:

Conductivity Controller

(144F) A new conductivity controller recently introduced by Mullard Electronic Products, Ltd., a British firm, provides a convenient and sensitive method for controlling concentration changes in a wide variety of processes. It operates on a modified wheatstone bridge network operating at a frequency of 2.9 kc. Process con-

(Continued)

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FORMER DRYER

Installed cost\$17,800
 Drying time.....24 hrs.
 Drying cost.....\$0.354 per 100 lb.
 (space required, 950 sq. ft.)

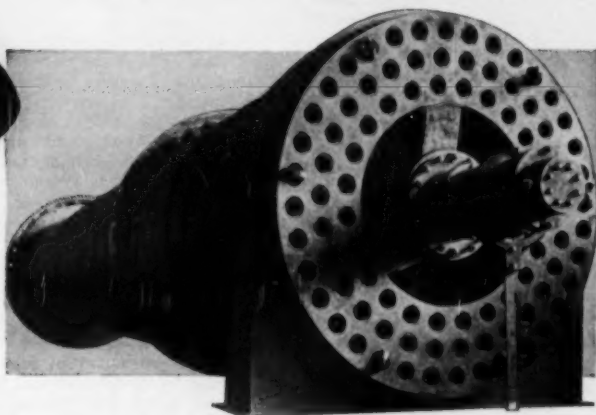
LOUISVILLE DRYER

Installed cost\$29,000
 Drying and cooling time.....45 min.
 Drying cost.....\$0.123 per 100 lb.
 (space required, 300 sq. ft.)

YEARLY SAVINGS

IN DRYING COSTS

ALONE... \$8,300



45 minutes—instead of almost 24 hours for drying!
 Contamination reduced to zero—no need for reprocessing
 90,000 lb. of crystalline chemical every year—
 at a cost of 50c per 100 lb.

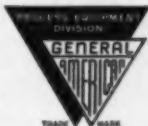
It all happened when a Louisville engineer examined
 this plant's old batch type drying process, and
 recommended the installation of a specially-designed
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NEW EQUIPMENT, cont. . .

trol is effected by use of an amplifier and relay circuit incorporated in the instrument. The control circuit may be arranged to give visual or audible signals, or to add reagents to the liquid as required.

The instrument is mounted in a rigid cast aluminum case with a water-tight lid. It is 12 1/2 in. high, 9 1/2 in. wide, 6 1/2 in. deep.

VALVES & FITTINGS



WASTE WITHOUT HAZARD:

Pipeline Coupling

(146A) The new Weld-Ends coupling, made by E. H. Wachs Co., is a device for quickly and safely rejoining oil or gas pipelines. It is designed for effective sealing, without welding, of joints in pipe from 2 in. to 36 in. in diameter. Full pipeline pressure can be restored immediately and final welding postponed until the area is safe enough for use of a torch.

The coupling is slid over the end of one pipe, then centered over the joint. Clamping and adjustment screws around the sides are pulled up as tightly as possible with a socket wrench. Thrust screws in the ends push against forged steel thrust rings, which in turn force a neoprene sealing ring into the space between pipe and coupling. The job is eventually finished, when safe and convenient, by fillet-welding the ends of the coupling to the pipe and seal-welding all screw holes. When used along with the Wachs pipe saw, it is possible to cut a section out of a pipeline and insert a new section without lighting a torch or having an open flame on the job.

USES NO SPRINGS:

Solenoid Safety Valve

(146B) A new solenoid valve made by Ross Operating Valve Co. is constructed without the use of any springs. This type of construction provides greater reliability when the valve is used as a safeguard against equipment failure. It ordinarily operates with line pressures of 40 to 125 psi., but it can be designed to work

outside of these limits. It is made in 1/2-in. to 1 1/2-in. pipe sizes, straight-way or three-way, normally closed or normally open models.



SIMPLIFIES PIPING INSTALLATIONS:

Stainless Fittings

(146C) A new line of corrosion-resistant fittings, designed to simplify installation and reduce costs of process piping jobs, has been announced by Horace T. Potts Co. The Speedline insert flange shown above consists of a corrosion-resistant, serrated insert in a carbon steel flange. This method of piping assembly eliminates many of the difficulties previously encountered in threading, vanstoning, or welding corrosion-resistant piping. An expanding tool and plain wrench are the only tools required for installing the Speedline insert flange. Sizes available include standard tubing O.D.'s and gages and nominal pipe sizes from 1/2 in. through 6 in.

Other new developments by Potts include a connector for obtaining proper alignment in joints between pipes with different wall thicknesses, and a low-cost, light-weight union. These new fittings are stocked in standard analyses of stainless steel and Carpenter No. 20.



CHASERS DIRT:

Butterfly Valve

(146D) Mud Products, Inc., has developed a butterfly valve for operation under the severe conditions encountered in drilling mud systems in the oil fields. Under these conditions, settling of dirt on the seat of ordinary gate valves prevents perfect

closure. The Mudco valve employs a wiping action which permits the disk to reach its closed position despite accumulation of foreign material in the body of the valve. The disk is fitted with an O-ring around its circumference, which provides a tight seal even under high pressures.

These valves are furnished in steel with stainless steel shafts, or in aluminum bronze. They are made in sizes from 2 in. to 6 in.



STOP COCK DE LUXE:

Regulating Valve

(146E) The Reynolds-Shaffer Co. has a new valve for use where a reproducible flow regulation is required. It is fully opened or closed with a quarter turn. Made in all-brass construction in 1/2-in. pipe size, it is fitted with O-ring packing and is guaranteed not to leak externally.

CAN BE STOOD ON ITS HEAD:

Solenoid Operating Valve

(146F) A new solenoid valve, manufactured by Airmatic Valve, Inc., can be mounted in any position without harm to the valve or solenoid. Constructed of cast naval bronze for corrosion resistance, it is suitable with such fluids as oil, water, and air. The valve is normally furnished in standard pipe sizes of 1/2 in. to 2 in., for pressures up to 225 psi. It operates on either a.c. or d.c.

PACKAGING & HANDLING

CAN BE SAFELY STACKED:

Pallet Box

(146G) The Ironbound Box & Lumber Co. has added to its line a hardwood box with two-way or four-way entry type pallet bottom. The box is reinforced with outside and inside steel corner angles bolted throughout. Spacing of bottom boards can be varied so as to accommodate standard fork trucks or hand pallet trucks.

Safe stacking of these boxes to ceiling
(Continued)



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TO MORE
CHEMICALS**



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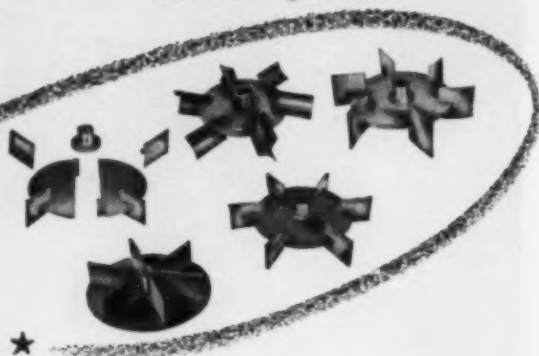
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This means that Mixco engineers can *accurately predict* what your process results will be. It also permits accurate *sizing* of the mixer—big enough to do the job without overloading, small enough to keep your horsepower requirements at a minimum.

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A COMPLETE LINE . . . UNEXCELLED TECHNOLOGY

NEW EQUIPMENT, cont. . .

ing height is permitted by the design of the extended and flared corner angles at the top of the box. Units are available in a number of sizes to meet any particular requirements.



DUAL PURPOSE UNIT:
Hand Lift Stackers

(149A) A new dual-purpose hand truck with a built-in hydraulic hoist has recently been introduced by Clark-Hopkins Equipment Corp. This hand lift stacker is designed for handling heavy cases and barrels between ground and truck levels where loading docks are not available. It is designed to fill the need for a small, light weight, highly maneuverable hand truck that will enable one man to load and stack heavy merchandise, after transporting from one location to another.

Although weighing only 111 lb., this unit has a capacity of 500 lb. and will lift these loads to tail-gate height of 54 in. The front of the 22-in. by 19-in. platform is flush with the floor when lowered.

WHERE SPACE IS LIMITED:
Small Lift Truck

(149B) Lyon-Raymond Corp. has added a 4,000-lb. capacity model to its Spacemaker line. This line of lift trucks is designed for use in narrow aisles and crowded working areas. It can stack loads at right angles to the aisle where the aisle is only 24 in. wider than the load length. A 36-in. long skid platform, for instance, can be right angle stacked from a 5-ft. aisle.

The new model is provided with a standard 24-in. wide platform with lengths ranging from 30 in. to 48 in. It is offered with a lowered height of either 7 in. or 11 in. With the stand-

ard 83 in. mast, 58 in. of elevation can be furnished.

FOR LIGHT DUTY APPLICATIONS:

Hoist Trolleys

(149C) Wright Hoist Div. has begun production of a new line of trolleys made in $\frac{1}{2}$ -ton to 3-ton capacity. These low-cost, lightweight trolleys are made for applications that do not require as high an efficiency or factor of safety as Wright heavy-duty trolleys. They are built only for standard I-beam sizes.

SAVES ON SHIPPING WEIGHT:

Fiber Drum for Liquids

(149D) Use of fiber drums for shipment of non-corrosive, non-flammable liquids in quantities greater than 5 gal. is being accomplished successfully for the first time, according to a recent report. The 55-gal. fiber drum is lined with a polyethylene envelope protected at the base by a heavy boot of creped duplex kraft paper. Its name, the FPEB drum package, signifies "fiber-plastic envelope-boot." Rohm & Haas Co. owns the patent covering this new development, but will grant licenses to responsible shippers. Rohm & Haas developed this container for its own use, and does not manufacture any of the elements of the package.

Tare weight of the new container is 50 to 75 percent less than that of conventional containers, it is stated. Another advantage is the ability to open and re-seal the container while

still protecting its contents. This feature is obtained by permitting the open top of the plastic envelope to overlay the top chime of the drum. A disk of plastic material is placed over the open end after the drum is filled and before the lid is positioned. A full-round sponge rubber gasket is cemented to the underside of the lid, and when the drum is closed, this gasket seals the plastic disk securely against the overlay portion of the envelope.

Suppliers who cooperated in the development of this new package are Continental Can Co., Visking Corp., Shellmar Products Corp., Hedwin Corp., Cincinnati Industries, Inc., and Kellogg Container Div. of U. S. Envelope.

WITH HYDRAULIC HOIST:

Electric Fork Truck

(149F) A new Elwell-Parker electric battery fork truck features a single cylinder, low-pressure, double-action hydraulic hoist. Advantages claimed for this truck are a faster, smoother action in lifting and lowering a load, automatic protection against overload, and a cushioning effect between truck and load.

The hydraulic cylinder is centered in the hoist frame. A hydraulic pump for hoist and tilt is direct-connected to an electric motor, independent of the truck travel motor. Design and arrangement of the hoist frame is similar to those in other Elwell-Parker high lift trucks. Both lower and

(Continued)



VERSATILE LIFT TRUCK CAN STOOP OR STRETCH

(149E) The new Tier-Master fork lift truck is provided with telescoping uprights which, in the low position, permit operation inside motor truck van bodies, yet will tier materials three pallets high when the uprights are extended to their maximum lift. With a lift truck of this design, materials handling can be

speeded up in operations where loaded pallets are tiered three high but still must be removed in and out of truck bodies or through restricted overhead clearance areas. Manufactured by the Mobilift Corp., the Tier-Master is rated at 2,000 lb. capacity, has an outside turning radius of 57 in. and a zero inside radius.

NEW EQUIPMENT, CONT.

upper frames are hot pressed alloy steel panels, and the upper frame is equipped with steel roller bearings.

Over-all height in the fully extended position is 145 in., and in the telescoped position is 83 in. Maximum lift of fork is 126 in. Rated capacity of this truck is 6,000 lb. Travel speed with full load is 5 mph.



SAVES ON SHIPPING COSTS:

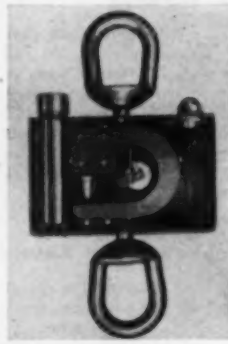
Materials Handling Box

(150A) A waste expense in materials handling is the tonnage charge made for trailer or freight car loadings of boxes of material not designed to utilize the full capacity of the vehicle's loading space. Minimum freight car rates are charged for loads of empty boxes regardless of weight. The Hazen knock-down materials handling box, developed by the Jervis B. Webb Co., attacks both these problems. The nesting features of the Hazen box permit stacking of 5 or 6 loaded boxes safely where formerly only 3 or 4 loaded boxes could be safely stored. When empty, the boxes can be disassembled so that 10 units can be knocked down and stored in the same space required for only 4 assembled boxes.

The Hazen box combines the stacking and strength features of rigid boxes with the consolidation features of other collapsible boxes. The removable side feature is quite important. Heavy items can be easily loaded into three sides, with the remaining side replaced when loaded. The nesting arrangement permits safe transportation via fork trucks for as many as three loaded units at one time. The disassembly features permit their use as pallets, open-side or three-side boxes; they can be doubled in depth by the simple addition of two extra sides and two ends. They are accessible to eight-way pickup by fork trucks.

These boxes are built in two standard dimensions—48 in. long with 27½ cu. ft. capacity, and 54 in. long with 30 cu. ft. capacity. All boxes are constructed of square steel tubular frames and corrugated steel panels, with the

sides secured by dowel pins fitting into holes provided in the base frame. They can also be procured with wire-mesh sides and canvas sides.



**PROTECTS MAN AND MACHINE:
Overload Signal**

(150B) For hoist installations where it is not desirable to cut into the hoist motor circuit but where some method of overload warning is essential, W. C. Dillon & Co. has developed an overload warning signal. This unit consists of a U-shaped pressure bar to which is mounted a sensitive microswitch. Setting is made for any point between 500 and 10,000 lb. by means of a load setting screw. Should the set load be exceeded in service, a red warning lamp lights up and a shrill signal is emitted by a Klaxon horn.

The device is self-contained, power being supplied by two ordinary flashlight cells. Gross weight of the unit is 15 lb.

LIKE SLICING CHEESE:

Bin Discharger

(150C) The Bulkbin Co., a British firm, has developed a novel device for discharging flour and other finely ground materials from bulk storage. The bin is provided with a number of 3-in. transverse slots at intervals across the width of the floor. Specially designed metal knives, attached at each end to driving chains, move slowly across this floor and in one action slice off and push the bottom layer of the material along so that it falls through the slots. This system can be driven with a small consumption of power by moving the knives one end at a time; the chains take up the drive alternately, and each knife moves with a diagonal action. This action is so efficient, it is claimed, that the discharger will start immediately, even if material such as flour has been allowed to stand.

The slotted bottom of the container is set at an angle so that the slicing action is downhill. The chains with their metal knives return along a level false bottom and sweep out the fallen material at a rate which can be varied at will. Use of the discharger allows storage bins to be built with vertical sides, representing big savings in space.



**WITH PILOT LIGHT:
Heat Sealer**

(150D) A new continuous hand rotary sealer, developed by Pack-Rite Machines, is suitable for heat sealing of bags, pouches, and innerliners made of scrim-backed or kraft-backed foil, polyethylene, vinyls, or Pliofilm. The operator feeds the material into the 8½-in. long preheater section where it is fused and softened, followed immediately by the free-rolling ball bearing rollers which apply the necessary final pressure, all in one continuous forward operation.

Constructed of cast aluminum, the unit weighs only 5 lb. It is equipped with two 150-watt cartridge-type heating elements. A pilot light indicates when the desired temperature has been attained.

IDENTIFIES YOUR PRODUCTS:

Package Printer

(150E) A new machine that automatically prints complete display designs on all four sides of corrugated, fiber, and wood shipping cases at the point of packaging has been introduced by Adolph Gottscho, Inc. The new machine, called the Markoprinter, is designed to make it practical for companies with varied product lines to print their own cases as they use them. This eliminates the need for maintaining large inventories of pre-printed cases for each different product and size, or of risking interruption of production schedules as a result of case supply shortages.

The machine automatically receives loaded cases, prints from one to four side panels (and the top, also, if required), discharges them to the next operation, at production rates up to 2,000 cases per hr. Printing is accomplished by means of deep-cut rubber

(Continued)



if


Michelangelo were alive . . .

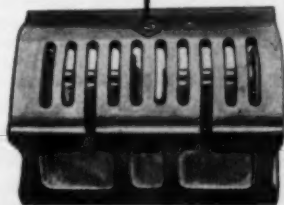
. . . he would probably consider the technical and metallurgical perfection of Sivyer castings as a work of art. A foundryman of no mean ability . . . he would be quick to recognize the craftsmanship of Sivyer methods . . . the know-how and precision with which a wide variety of complicated castings are produced.

Sivyer insistence on the highest standards

of compositional accuracy—uniformity of internal structure, dimensional accuracy and good finish means lower costs—better performance. It will pay you to consult Sivyer on your steel casting problems.



the HALLMARK of better steel castings

Sivyer castings are identified with the famous  marking—your assurance of the finest in high alloy and specification steel castings.



SIVYER

SPECIALISTS IN HIGH ALLOY AND SPECIFICATION STEEL CASTINGS

SIVYER STEEL CASTING COMPANY • MILWAUKEE  CHICAGO 

NEW EQUIPMENT, CONT.

dies mounted on rotary die-wheels. Rotation of die-wheels is synchronized with package travel to assure accurate register.

The inking system is identical with that of large aniline printing presses. It provides both for constant recirculation of the ink supply and for metering a precisely measured film of ink to the surface of the printing die. Each Markoprinter is built to meet the individual user's special requirements, particularly in regard to its adjustability for handling cases of various sizes.

HEATING & VENTILATING



PORTABLE MOISTURE CONTROL:

Adsorption Dehumidifier

(152A) Dryomatic Corp. has begun manufacture of a new adsorption-type package unit for control of humidity and protection against mold and corrosion in warehouse and storage areas. The Model 100 unit is a three-channel, continuous adsorption dehumidifier with plug-in automatic operation. It is effective singly in enclosed spaces up to 25,000 cu. ft.; in larger areas a number of them can be used in parallel. Humidity levels as low as 15 percent can be maintained, it is claimed.

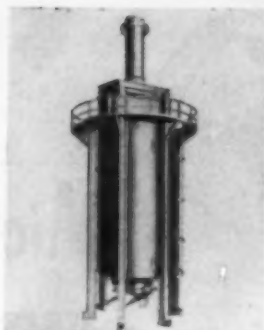
This unit measures 45 in. long, 19 in. high, and 16 in. wide. It operates on 110-volt current; maximum power consumption is said to be 1.2 kw.

REQUIRES ONLY ONE CONNECTION:

Humidifier Unit

(152B) This new humidifier unit, available from the Industrial Materials Purchasers Co., requires no ducts, pumps, compressed air or steam lines. The only connection required is a water supply from ordinary drinking water mains at line pressure. It employs a centrifugal atomizer.

Rated capacity is 1 gal. per hr. of vaporization. Its dimensions are 12 x 14 x 22 in., and it weighs about 50 lb.



PROCESS HEATER

(152C) If your process requires heat at temperatures above existing steam supply, or if operation may be improved or speeded up by higher temperatures, this new Struthers Wells direct-fired heater will be of interest. It is made in capacities of 100,000 to 15 million Btu. per hour.



WITH CLOG-PROOF NOZZLES:

Spray Cooling Towers

(152D) Binks Mfg. Co. has developed improved blower-type Dry-Fan cooling towers. In this type of tower, air enters through a squirrel-cage fan at the bottom of the tower and is exhausted through redwood drift eliminators at the top. The new towers are made in both single-fan and two-fan models. Special adaptor hoods are available for indoor installations.

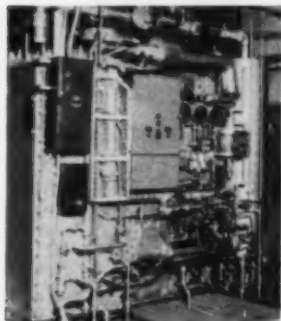
These towers are designed with a liberal air-to-water ratio. They are equipped with Rotojet clog-proof spray nozzles which provide fine fluid break-up for maximum heat transfer. Removable panels facilitate inspection of the nozzles. The smallest single-fan tower measures 2 ft. x 2 ft. x 6 ft.; the largest two-fan model measures 6 ft. 6 in. x 11 ft. x 7 ft. 6 in. Capacities range from 3 to 60 tons of refrigeration.

FOR SMALL-SCALE WORK:

Gas-Fired Oven

(152E) Carlson Co.'s new gas-fired baking oven is a general purpose oven designed for small-scale production work or for use in shops and laboratories. Temperature can be automatically controlled within the range of 250 to 650 deg. F. A 3-in. dial thermometer is mounted in the door, indicating the actual inside temperature at all times.

The oven is well insulated and does not require an exhaust flue for efficient operation. Heating chamber is 10 in. wide, 9 in. high, and 12 in. deep, with two shelves.



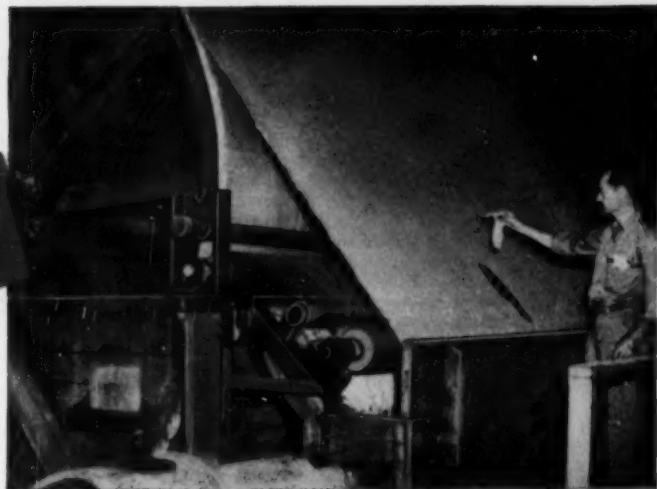
RECIRCULATION DOES IT:

Steam Generator

(152F) A compact steam generating plant developed by Combustion Engineering-Superheater, Inc., makes use of what is called the controlled recirculation principle. The high rate of heat transfer made possible by use of this principle permits maximum steam production per unit of heating surface, thus obtaining a high steam output per unit of space and weight.

In operation, an external pump circulates water at high velocity through the boiler tubes, promoting heat transfer and minimizing scale formation on tube surfaces. The mixture of steam and excess water leaving the outlet header passes through a centrifugal separator; the water returns to the pump and the steam goes to the exit steam line.

Originally developed for heating diesel-electric trains, this generator is applicable in process plants where one or more of the following conditions apply: Where high-pressure steam is required in relatively small quantity; where steam is required in remote locations; where steam demands are intermittent or highly fluctuating. (Continued)



CLEANER, DRYER CAKE *Continuously* with FEinc STRING FILTERS



ALUMINA HYDRATE
ALUMINUM STEARATE
BARIUM SULPHATE
CALCIUM CARBONATE
CALCIUM HYPOCHLORITE
CLAY
DDT
DISODIUM PHOSPHATE
IRON OXIDE
LACTIC ACID
LITHOPONE
MAGNESIUM HYDROXIDE
NEUTRALIZED WASTE
PICKLE LIQUOR
PENICILLIN
SEWAGE
SILICA GEL
SODIUM CARBONATE
SOYBEAN PROTEIN
STREPTOMYCIN
STARCH
CORN, POTATO, RICE, WHEAT
TITANIUM HYDRATE
2,4-D
WHITE LEAD
ZINC OXIDE
ZINC STEARATE
and many others

Because it gives a cleaner, dryer cake and clearer filtrate without "stop and go" losses, the FEinc rotary vacuum filter proves out with a bigger yield on job after job. It's the String Discharge that does it. Endless strings neatly pick the cake off the cloth in one continuous sheet. Smearing, blinding and scraping wear are eliminated, hence you use finer filter cloths which come close to being ideal. FEinc handles cakes as thin as 1/16 in. or as thick as you want, ranging from "impossible" slimes to matty, fibrous cakes. Other features: The FEinc compression dewatering mechanism removes more moisture, and the FEinc submergence washing mechanism washes cakes down to unbelievable purity. Here are three typical jobs:

Manufacturer changed entire process when scraper filters plugged up after few revolutions on new, sticky, clay-like material. Tests on FEinc Filter showed no plugging after three days. Manufacturer returned to original process at lower costs—with FEinc Filters.

To wash out sulphates, difficult gelatinous cake was recycled no less than nine times on ordinary washing filters. FEinc cut it down to five cycles, delivered pure cake.

Considerable loss, wet cake, and low capacity resulted from scraper filter on calcium carbonates. Same size filter with FEinc String Discharge and Dewatering used lighter, more efficient cloth. Said user: "filtrate is clearer ... cake pick-up is better," and above all, cloth lasted 50% longer.

WRITE FOR TECHNICAL BULLETIN 103

21

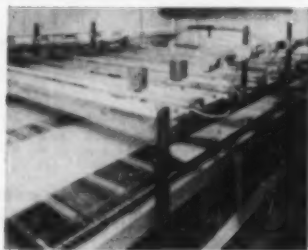


FILTRATION ENGINEERS INC.
155 ORATON STREET • NEWARK 4, NEW JERSEY

NEW EQUIPMENT, cont. . .

tuating, where space is at a premium. It will produce three to four times as much steam per cu. ft. of space occupied, it is claimed, as small conventional water-tube boilers or present-day package-type fire-tube units.

The unit is furnished complete with feed water pump and control, fuel equipment and control, combustion control and safety devices, forced-draft fan, safety valves, circulating pump, and all other auxiliaries. Available sizes range from 2,800 to 6,000 lb. per hr., with operating pressures up to 300 psi. The 6,000-lb. unit burning light oil or gas is 6 ft. 11 in. long x 5 ft. 5 in. wide x 6 ft. 11 in. high, and the heavy oil-burning unit is only slightly larger.



PREVENT SOGGY SANDWICHES:

Radiant Heaters

(154A) Chromalox radiant heaters, made by Edwin L. Wiegand Co., were recently installed for drying vinyl sheets used in making safety glass. The sheets are 0.015 in. thick and vary in width from 12 in. to 42 in. The problem was to dry the sheeting completely prior to sandwiching it between sheets of glass.

The installation uses six 2,275-watt heaters with an over-all length of 61½ in. and a heated length of 48 in., placed on 10-in. centers and mounted 6 in. above the vinyl sheeting. The conveyor has a width of 48 in. and a speed of 22 fpm., giving a total radiation exposure time of 15 sec. In the event of stoppage of the conveyor, the heaters are turned away from the sheeting by means of a mechanical lever operating through connecting linkages.

USES BERL SADDLES:

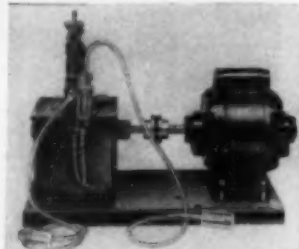
Packed Cooling Tower

(154B) Distinctive feature of a new cooling tower made by Aqua-Therm, Inc., is the use of a packed bed of Berl saddles for improving the contact between air and water. Use of this familiar type of packing

is said to permit a reduction of tower height and pumping heads up to 50 percent.

Aqua-Therm claims another advantage for this new tower—it makes practical the use of concrete blocks or other fire and vermin-proof masonry material for tower shell construction. When required, complete corrosion resistance can be provided by lining the tower shell and coating all steel parts. Towers can be designed for either forced or induced draft; the former is usually preferred.

PUMPS



ADJUSTABLE WHILE RUNNING:

Reagent Pump

(154C) The new Manzel hypochlorinator, although designed specifically for water and sewage treatment, can probably be adapted for many chemical reagent feeding jobs. Cylinder is made of FA-20 alloy, plungers of Hastelloy, valves of Carpenter No. 20 alloy, and other parts of Lucite. Packing is of Teflon.

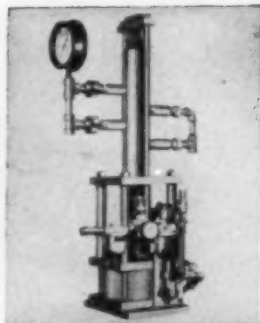
The standard unit employs a ½-in. plunger and has a capacity of 5.5 pints per hr. at 35 strokes per min. A larger unit with a ¾-in. plunger and a capacity of 10.5 pints per hr. is also available. Pump capacity can be adjusted while running by shortening or lengthening the plunger stroke.

MIGHTY MIDGET:

Compact Pump

(154D) Eco Engineering Co. announces the M-3, a new addition to its line of pumps. It is the smallest and most compact unit the company has ever designed, with an over-all length of only 3½ in. Its size permits it to fit in cabinets where only limited space is available.

Capacity of the M-3 is 1.65 gpm. at 1,750 rpm., operating against pressures up to 150 psi. The pump will operate in either direction and can handle thin or viscous fluids. It is available with or without flange-mounted motor.



HYDRO-PNEUMATIC PUMP

(154E) This improved pump, made by Aldrich Pump Co., is useful for making hydrostatic tests of tubing and pressure vessels and for other services requiring high pressure at small volume. Using normal plant air as the power medium, it provides output pressures up to 20,000 psi.

NOR SNOW NOR RAIN NOR SLEET:

Rotary Pumps

(154F) A new series of totally-enclosed rotary pumps for capacities from 20 to 92 gpm. has been developed by Viking Pump Co. This type of pump previously was available only in a 200 gpm. size. Totally enclosed with oil-tight and water-tight guards, these pumps can be used safely outdoors in all kinds of weather without any shelter. The pump shaft is made of stainless steel to prevent rusting when exposed to weather.

ELECTRICAL & MECHANICAL

CALCIUM IN, ANTIMONY OUT:

Storage Battery

(154G) A new type of storage battery, developed by Bell Telephone Laboratories, employs calcium instead of antimony as the hardening agent for the lead alloy in the grids and other metallic parts of the battery. This new type of battery is said to require much less maintenance and to last at least 50 percent longer than those now in use. It was developed for the specific requirements of the telephone industry, and is not at present recommended for other uses. As it becomes commercially available and more information as to its characteristics is obtained, however, its field of usefulness may be considerably extended.

A minute trace of an unusual gas in a telephone office started Bell chemists on the road to this new battery. They were searching for atmospheric (Continued)

WHY ABBOTTS DAIRIES CHOSE A REFRACTORY FORTIFIED WITH ALCOA ALUMINA

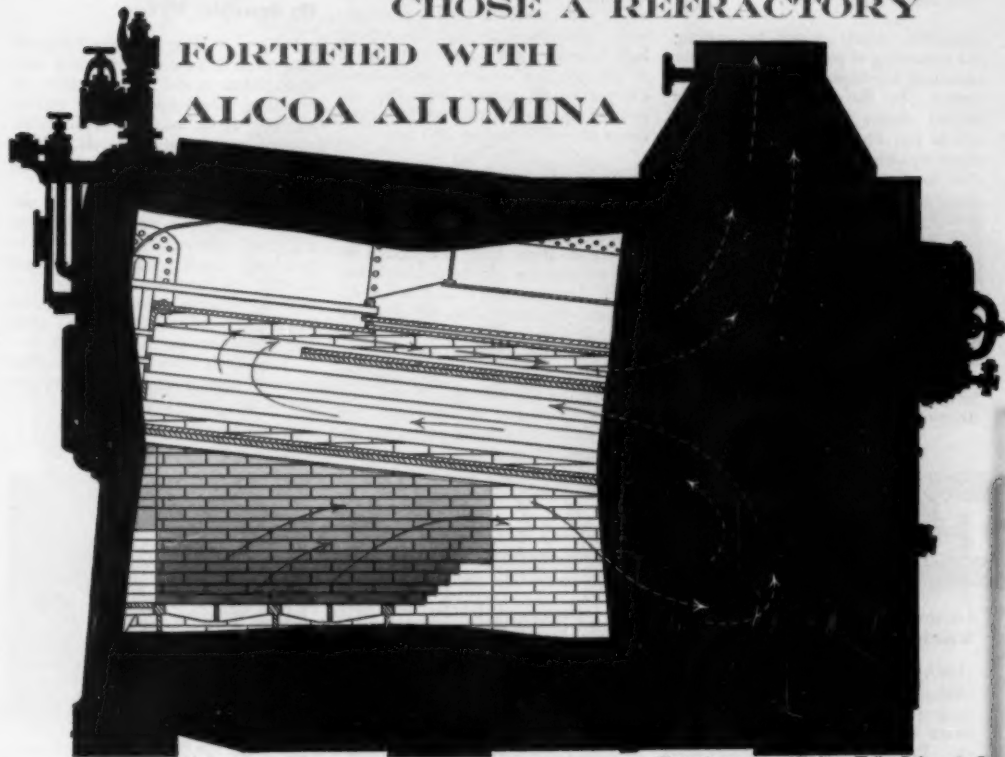


Illustration courtesy of Harbison-Walker Refractories Co.

Horizontal type boiler at Cameron creamery uses Korundal 90% ALCOA Alumina-content brick to resist extreme slagging by high iron oxide coal ash at unusually high temperatures. Korundal is used to a height of 30' above grates in side wall and for complete 9" facings of bridge and front walls.

REFRACTORY BRICK must prove itself the hard way at Abbotts Dairies, Bruce and Cameron, Wisconsin.

Six months of the year, round-the-clock, white-hot flames and molten slag torture boiler furnace walls in an extremely severe test for the best refractories available.

In 1944, Korundal, a 90% ALCOA Alumina-content brick, was installed experimentally in one of the Bruce creamery boilers. After a convincing demonstration of several years, high alumina-content Korundal was installed in Abbotts Cameron creamery boiler furnace,

because down-time and repairs cost more than good refractories.

Refractory brick made with ALCOA Alumina offers you these money-saving advantages:

- Strength and stability under load at high temperatures.
- Resistance to spalling, abrasion and fluxing at high temperatures.
- Resistance to corrosive slags and fumes.
- Low porosity.
- Negligible shrinkage.

You can buy refractory brick and other shapes, containing various percentages of ALCOA Alumina to meet your requirements, from leading manufacturers. We'll gladly refer you to dependable sources of supply. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 602d Gulf Building, Pittsburgh 19, Pa.

Alcoa Chemicals



ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS
ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOROBIC ACID • ENYOLITE • GALLIUM

NEW EQUIPMENT, cont. . .

impurities which might be causing the tarnishing of parts of the elaborate switching mechanism used in the dial system. In the atmosphere of the battery rooms they detected a gas which was finally identified as antimony hydride. Although not the solution to the tarnishing problem, this discovery led to the conclusion that loss of antimony from the antimony-lead parts of standard batteries was causing the battery deterioration. Previous research had showed that less than 0.1 percent of calcium, compared with the 12 percent of antimony usually employed in battery alloy, would sufficiently harden lead for use in cable covering. The lead-calcium battery was the logical outcome of these discoveries.



USE LOWER INPUT SPEEDS:

Variable Speed Drives

(156A) The new 150 series of Graham variable speed drives in sizes from $\frac{1}{2}$ to 1 $\frac{1}{2}$ hp. is designed to use lower input speeds than former models. Previous Graham transmissions in this size range were designed for 3,600 rpm., and where lower input speeds were used, the drives were spring loaded. The new series is designed for operation at input speeds of 1,800 and 1,200 rpm. without spring loading. Absence of spring loading makes it possible to change the speed of the transmission while running or stationary. Lower input speeds also permit cooler, quieter operation.

All units are available with motor, or with input shaft extension for coupling to a separate motor or belt drive. Standard construction provides for output speed variation from zero to 37 percent of input speed. Micrometer control is furnished as standard with the 150 series; remote controls are available.

DIRT CAN'T GET IN:

Geared Motor

(156B) A new type geared motor is being introduced by Sterling Electric Motors. Known as the Kloss-Tite, it is designed for use in atmospheres containing non-explosive dusts, vapors, and injurious foreign

materials. External fan cooling is provided. The motor is totally enclosed, with labyrinth seals and heavy-duty ball bearings, and can be mounted in any position without modification. Output shaft ratings are the six AGMA speeds starting at 780 rpm. down to and including 200 rpm.

OUT GOES OIL, WATER, DIRT:

Air Cleaner

(156C) Continuous removal of petroleum vapor from compressed air and other gases can be accomplished by the Vape-Sorber, a new device developed by Selas Corp. of America. This device can be installed in air lines to instruments or other critical pneumatic operations where oily air has detrimental effects. It will also remove water, free oil, emulsions, and dirt. Using no moving parts, the device employs ceramic filters in conjunction with specially compounded activated carbon.

LIKE A DUCK'S BACK:

Splash-Proof Motors

(156D) Westinghouse Life-Line splash-proof motors in frames 326 and smaller can now be obtained in an improved design suitable for applications where splashing or hosing down exceeds NEMA standards. These motors incorporate gasketed cast iron conduit boxes with provision for attaching waterproof conduit. Motor windings are given multiple dips and bakes in moisture-resistant varnish. Baffles inside the rear splash-proof hood prevent water creeping up inside the hood, and neoprene seals on the shaft gives protection against the entrance of water into the bearing housing, even under severe hosing conditions.



CONVEYOR DRIVE

(156E) A special Westinghouse speed reducer is used in the construction of this new overhung pulley developed by National Iron Co. for driving heavy belt conveyors. A net saving of over \$8,000 is reported in the first installation.

PUTTING ON THE PRESSURE:

Hydraulic Press

(156F) The Denison hydraulic Multipress is now manufactured in a new 50-ton model which retains all operating advantages of the smaller models. It is available with either manual or automatic controls and can be equipped to operate through dual hand levers for maximum safety.

The 50-ton press offers a fully adjustable ram stroke up to 15 in. Pressing and approach speeds are independently regulated, permitting rapid traverse in combination with controlled working speeds. Maximum approach speed is 290 ipm. and maximum pressing speed is 145 ipm.

Time delay control and many other types of operating sequences are also available.

SAFETY



JOHNNY ON-THE-SPOT:

Fire-Fighting Trailers

(156G) Preakness Engineering Co.'s fire-fighting trailers are designed to fill the gap between hand extinguishers and self-propelled fire trucks. Fires beyond the scope of hand extinguishers can be brought under control with this unit before fire trucks could reach the scene.

The pictured model carries its own 200-gal. water supply. When necessary the portable gasoline-driven pump can be detached and easily carried to any water supply to supplement this quantity. Water can be discharged as either a straight stream or water fog, or it can be used with a mechanical foam nozzle for smothering flammable liquid fires. The complete equipment includes nozzles, extension ladders, fire axe, portable extinguisher, and suction strainer.

NO DISCONNECTIONS NECESSARY:

Cylinder Weighing Device

(156H) In fire protection systems based on carbon dioxide cylinders, each cylinder should be weighed

(Continued)

The right spot



What is the right spot for a PAYLOADER? It's any place inside your buildings or in the yard where bulk materials are being handled by laborious or other obsolete methods. Thousands of these special tractor-shovels are in "right spots" today cutting costs, solving manpower shortages and increasing output.

PAYLOADERS are able to pay for themselves in a few months because they are designed for the specific job of handling bulk materials of all kinds — loading, unloading, scooping, lifting, carrying, dumping and spreading. Outstanding reasons for the performance and acceptance of PAYLOADERS include: short, compact, space-saving design; multiple reverse speeds; large pneumatic tires that permit operation indoors and outdoors . . . on paved or unpaved areas; simple, easy operation; complete hydraulic bucket control.

The 12 cu. ft. model HA shown is an outstanding box car unloader. It is the smallest of six PAYLOADER sizes which range up to 1½ cu. yd. bucket capacity. Every PAYLOADER is backed by 30 years of manufacturing experience and by a world-wide Distributor service organization. The Frank G. Hough Co., 754 Sunnyside Avenue, Libertyville, Illinois.

Write for literature on PAYLOADERS and the name of your Hough Distributor. He'll be glad to help you find the "right spot" for the right size of PAYLOADER in your operations. No obligation.



- Unload box cars.
- Dig and carry fertilizer, chemicals, other bulk materials.
- Clean up gangways, aisles and other areas.
- Load and unload trucks.
- Load box cars.
- Feed conveyors, elevators, hoppers, mixers.
- Charge mullers, tumbling barrels.
- Lift-haul-push-pull.
- Stockpile coal, coke.
- Remove snow.



PAYLOADER®

THE FRANK G. HOUGH CO. • Since 1920



Submerged Combustion

DIRECT FIRED GAS BURNERS



Exposed view Submerged Combustion Burner as now used to concentrate calcium chloride solution and ferric chloride.

A NEW METHOD FOR HEATING and EVAPORATING CORROSIVE AND NON-CORROSIVE LIQUIDS

- ★ Flame burns below surface, bringing liquid quickly to heat.
- ★ Hot exhaust gases forced through liquid carry away moisture.
- ★ Provides rapid evaporation and concentration of acids, salt solutions, suspensions. Also adapted to heating water and solutions.
- ★ Installed in any type tank. No boiler room required. Use any type gas—natural or manufactured. Automatic in operation.

Free

Send for descriptive circular No. 52 and details



SUBMERGED COMBUSTION CO.

OF AMERICA, INC.

759 LOGAN STREET

HAMMOND, IND.

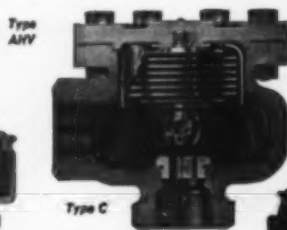
Nicholson Steam Traps

CUT HEAT-UP TIME 48%

A large processor recently reduced the heating cycles of cookers from 105 min. to 50-60 min., by substituting Nicholson thermostatic steam traps for a mechanical type. This effected a gratifying production increase of 37%. Reasons for Nicholson's faster heat transfer: operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air venting. To learn why an increasing number of leading plants are standardizing on Nicholson thermostatic traps send for our catalog.



Type AU



Type C



Type B



Type A

5 TYPES FOR EVERY APPLICATION, process, heat, power. Sizes, 1/4" to 2"; press. to 225 lbs.

W. H. NICHOLSON & CO., 206 Oregon St., Wilkes-Barre, Pa.

Sales and Engineering Offices in 53 Principal Cities

NEW EQUIPMENT, CONT.

at least once a year to make certain it contains the correct weight of charge. This precaution is important to guarantee proper operation if and when the system is activated in time of emergency. Using a new device just announced by American-LaFrance-Foamite Corp., it is now possible to weigh each cylinder without taking the system out of service.

The device consists of a tripod stand with a lever and a 200-lb. scale. The operator loosens the bolts which hold the cylinders in place, inserts the fulcrum under the neck of the cylinder valve, and presses down the hand lever until the cylinder clears the floor. The reading on the scale will show the weight of the cylinder. The device is easily portable.

WITH OR WITHOUT FOAM:

Fire Extinguisher

(158A) A new fire extinguisher, produced by National Foam System, Inc., can deliver a water stream as well as a foam stream. Known as the Foamster, it may be switched from water to foam by use of a trigger valve, without shutting down the unit. This feature allows the operator to conserve foam while shifting position, a distinct advantage over foam engines which have to be completely recharged after once being shut down.

The unit is less than 2 ft. high and weighs only 26 lb. with charge. Depending on the pressure and type of foam liquid used, it will deliver up to 540 gal. of foam, has a range of up to 50 ft., and will last up to 6 min.

GOODBYE TO GERMS:

Air Sanitizer

(158B) A dispenser for spraying glycolized Ozium into the air is now being manufactured by Woodlets, Inc. The purpose of the glycol spray is to reduce the hazard of infection from airborne germs. It is reported that absenteeism due to sickness has been reduced in several plants when using this method of controlling infection.

NOTHING UP THE SLEEVE:

Glove Insert

(158C) A new device to minimize the hazard of dangerous liquids and dust from leaking into workers' gloves or on their arms is announced by the Standard Safety Equipment Co. The Seal-Tight sleeve consists of an adjustable tapering insert for use under gauntlet-type rubber gloves together

with a tapering rubber sleeve hermetically sealed to protective fabric garments. When the glove is inserted into the sleeve and pulled tightly away a rubber-to-rubber contact is made which effectively seals the workers' arms and hands.

EVEN MONEY, TAKE YOUR CHOICE:

Face Shields

(159A) A new line of face shields, permitting the choice of specific visors for specific types of hazards, has been introduced by Mine Safety Appliances Co. The Chempruf visor is specially designed to guard the face, eyes, and neck against chemical splash, while the Chipruf visor offers particular protection against light flying particles. Both visors are interchangeable on the standard M-S-A headgear.

VERSATILE VINYL AGAIN:

Safety Gloves

(159B) Plasticote Glove Co. has developed a safety glove made of vinyl resin which is claimed to withstand immersion in gasoline, hot oils, and xylene. These gloves may even be safely used in strong alkali solutions and as high as 40 percent ferric chloride without deterioration, according to the manufacturer.

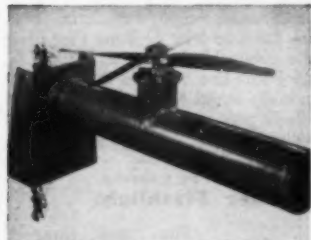
CONSTRUCTION MATERIALS

CONTAINS CHROMIUM CARBIDES:

Hard Facing Rod

(159C) The Alloy Rods Co. is producing a new oxyacetylene welding rod for hard facing against medium impact and high abrasion. Known as Wear-Flame 40, it is a centrifugally-cast rod consisting of highly wear-resistant material.

(Continued)



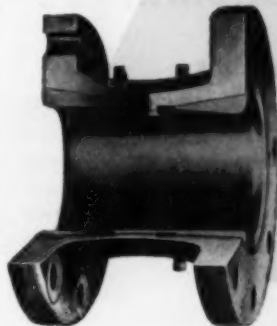
CORROSION-RESISTANT FAN

(159D) This exhaust fan was recently made by International Engineering, Inc., specifically for handling sulphuric acid fumes. It is constructed of Carpenter No. 20, a stainless alloy capable of withstanding sulphuric acid attack at temperatures up to 176 deg. F.

FOSTER FLOW TUBE*

(Graphic Portals)

SHORT...not long!



The picture above sectionalizes one of our standard 12 inch Foster Flow Tubes. Put a rule on it, lengthwise and diametrically. What do you make the length-diameter ratio? About 1½ to 1?

Yes, 1½ to 1 is about the maximum ratio of length to diameter in the Foster Line of Flow Tubes in sizes 3" and above. Some units have less than a 1 to 1 ratio, particularly when high velocities are encountered. What does this mean to you in the way of installation costs and housing? You can readily picture how easy it is to set the Tube in a line. Just like a section of pipe. And with this compactness is an accuracy which not only equals the accuracy of conventional long primary devices but in most cases exceeds it. This is due to the greater pressure differentials for any given main-to-throat reduction.

Yes, you get great compactness and ease of installation with the Foster Flow Tube. You also can count on satisfactory accuracy. As for your specific applications, write us in detail giving both processing and installation requirements. Standard sizes come in all commercial pipe diameters, flanged or screwed connections. Standard lining is bronze; other metals to order.

*A Proved Flow Tube Added to Foster Line of Regulating Valves

FOSTER ENGINEERING

Company

835 Lehigh Avenue • Union, N. J.

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...CUSHION CHECK VALVES...ALTITUDE VALVES...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN VALVES...VACUUM REGULATORS OR BREAKERS...STRAINERS...SHIMS...SAFETY VALVES...FLOW TUBES

(see opposite page)

BUT DO YOU KNOW WHAT WE'RE DOING IN ION-EXCHANGE?



FOR INSTANCE,
DO YOU KNOW THAT DORR

designed the plant, supplied the equipment and supervised the initial operation of the biggest ion-exchange installation ever installed for purification of waste fruit juices?



a two-stage D-I System for the recovery and purification of a new organic chemical; process developed by the client... equipment supplied by Dorrr?



ideal for the production of 100 to 1000 gallons per hour of high-purity water at low cost... as demonstrated at an East Coast pharmaceutical plant where D-I water is costing but 13 cents per 1000 gallons?



These are typical examples of our work in ion-exchange... indicative of the scope of our service and equipment range. If you are currently exploring the possibilities of ion-exchange for new processes or those already established, we will be glad to work with you on any basis you desire. And our ion-exchange facilities are backed by solid experience in chemical engineering.

Bulletin 4081 hits the high-spots of Dorrrco D-I Systems. Address your request to Ion-Exchange Division, The Dorrr Company, Engineers, Barry Place, Stamford, Conn.



DORR

WORLD-WIDE RESEARCH - ENGINEERING - EQUIPMENT

Associated Companies and Representatives in the principal cities of the world

NEW EQUIPMENT, cont. . .

sistant chromium carbides contained in a hard iron, chromium, manganese alloy matrix. Hardness of overlays deposited with this rod is 56 to 58 Rockwell C; hardness is retained at relatively high temperatures, it is claimed.

Sizes available are $\frac{1}{4}$ in. diameter by random lengths; $\frac{1}{2}$ in. to $\frac{3}{4}$ in. diameters in 14 in. lengths. Typical applications include facing of conveyor screws and mill hammers.

FOR CAST IRON WORK:

Brazing Rods

(160A) A new gas welding and brazing rod for cast iron work has been developed by All-State Welding Alloys Co. This new rod arrives on the scene at a very opportune time, inasmuch as it employs less critical material than normally used in nickel-base rods. It is recommended as general purpose for both salvage and production, including repairing breaks and cracks, filling blow holes, and building up worn surfaces. Brinnell hardness is 170 to 200.

NUTS AND BOLTS, TOO:

Stainless Hose Clamps

(160B) A new line of stainless steel hose clamps is announced by the Specialty Products Co. Already in mass production, these new clamps are available in sizes ranging from $\frac{1}{4}$ in. to 2 in. The clamping bands are made of 26-gage stainless steel, while the ears are of 18-gage stainless. Even the nuts and bolts are stainless steel.

FOR CORROSION RESISTANT PIPING:

Plastic Bushings

(160C) The Carlon Products Corp. can now supply injection-molded plastic reducing bushings and end plugs for use with Carlon plastic pipe. Bushings are available in 15 different sizes, ranging from 2 in. \times $1\frac{1}{2}$ in. down to $\frac{3}{4}$ in. \times $\frac{1}{4}$ in. Pipe plugs are obtainable in six sizes from 2 in. to $\frac{1}{2}$ in. The bushings should be especially useful for joining sections of plastic pipe to previously installed metallic systems.

NOT AFFECTED BY MOISTURE:

Rubber Flashlight

(160D) Two- and three-cell rubber flashlights that are described as breakproof and waterproof are now available from Lennan Products, Inc. Neither excessive moisture nor dryness affects the instant operation of these flashlights, it is claimed. The specially engineered head design facilitates easy changing of batteries or bulbs.—End

When you buy a LIME SLAKER

do you want...



Cutaway view of Dorco Slaker showing Classifier section at left, Slaking compartment at right.

HIGH
EFFICIENCIES
?

LOW
FIRST COST
?

LOW
MAINTENANCE
COST
?

COMPACTNESS
?

OPERATING
SIMPLICITY
?

Chances are you want them all . . . and you can get them all with a Dorco Slaker . . . the only available unit that does the complete job of slaking and effective grit removal in a single tank. One of the six standard sizes . . . ranging in capacity from 5 to 200 tons of CaO per 24 hours . . . will be right for your slaking problem if you need more than 5 tons per day. Write for Bulletin #7281 for more complete information.

With the Dorco Slaker you get . . .

- HIGH EFFICIENCIES . . . large unit capacity because of tank design and rapid hydration because of mechanical agitation add up to maximum overall efficiency.
- LOW INSTALLATION COST . . . the self-contained Dorco Slaker is shipped almost completely assembled. Erection is easy . . . no field welding . . . no costly piping or launders to connect Slaker and Classifier.
- LOW MAINTENANCE COST . . . replaceable 1" thick white iron liners on sides and bottom of Slaker tank minimize abrasion and corrosive problem. If needed, eventual replacements are inexpensive. All bearings are above solution level.
- NEAT, COMPACT INSTALLATION . . . The Dorco Slaker eliminates the usual unsightliness of the slaking operation. It is readily ventilated and minimizes operating hazards.
- OPERATING SIMPLICITY . . . necessary only for operator to check periodically the rate of lime and water addition. Control instruments are available to reduce operating attention to occasional observation only.

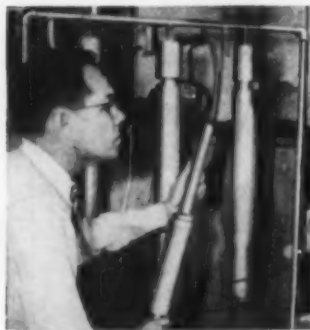
BETTER TOOLS *today*
TO MEET TOMORROW'S DEMAND



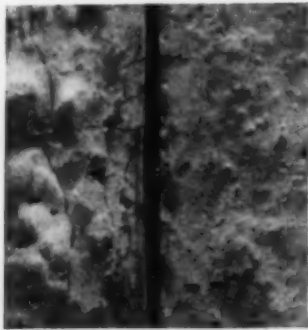
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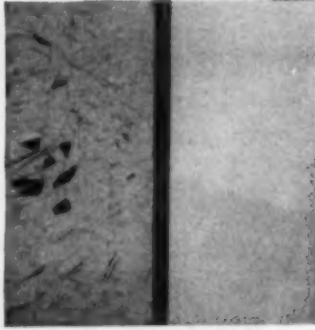
THE DORR COMPANY • ENGINEERS • STAMFORD, CONN.
Associated Companies and Representatives in the principal cities of the world



TRUCK EXHAUST, 6 mo. of it, failed to fade paint based on Plaskon's resin. Pipes on rack withstood 1,500 deg.



SOLAR RAYS, 2 mo. with weather, did not affect stucco treated with GE silicone-alkyd resin. Left panel untreated.



PROLONGED HEAT, 350 deg. F. for 50 hr., did no harm to Plaskon's silicone-alkyd film. Melamine-alkyd failed.

Newest in Silicones

The chemicals that, like Shadrach, Meshach, & Abednego laugh at heat, are still multiplying. Two big names are in on the latest development, silicone-alkyd coating resins. (162A)

First to make the resins commercially available is Plaskon Div., Libby-Owens-Ford Glass Co.

PLASKON SILICONE-ALKYDS

The resins, designated Plaskon ST-856, ST-873, and ST-881 silicone-alkyd resins, are expected to find wide use in military applications because of their important properties, particularly heat resistance. Other advantages include excellent resistance to weathering, humidity, chemicals and salt spray; plus satisfactory performance under widely varying climates. Expected uses for silicone-alkyd resins will be in coatings for space heaters, transformers, motors, chemical and refinery equipment and a long list of other uses.

In addition to the high heat resistance that is the trade-mark of silicone products, coating films formulated with silicone-alkyds have superior hardness, abrasion resistance, adhesion and flexibility plus a high degree of resistance to solvents, acids and alkalis. Of considerable importance also is the fact that the resins retain these

properties over a wide range of temperature.

The heat resistance of silicone-alkyd films is considerably higher than most purely organic films. They maintain high gloss and stable color in the range of 400 to 500 deg. F. in the case of ST-856 and ST-873; and the ST-881 resin for aluminum finishes shows no failure of film properties at temperatures as high as 1,500 deg. F.

The hardness and abrasion resistance are reported equal to, or better than, the best melamine-alkyd combinations now in use. Adhesion and flexibility superior to many organic coatings can be had without sacrificing the hardness and abrasion resistance.

Resistance of a silicone-alkyd film to organic solvents and strong acids was reported to be particularly high and its alkali resistance is equivalent to the best baking enamels.

The ST-856 resin is a baking enamel for general industrial use where heat is deleterious to usual coating films; and excellent durability in exterior or interior exposure is necessary. Its counterpart as an air-drying resin is ST-873 which can consequently be used for larger finishing areas than could be baked. This resin has potential use in consumer and maintenance paints since it can be sprayed or brushed on. ST-881 is a vehicle for aluminum or similar-pigment paints and has the advantages of dur-

ability, flexibility and adhesion plus ability to maintain its film properties at extremely high temperatures. Low temperatures have little or no effect on the silicone-alkyd films. All are intended to be used as one coat applications.

Price—At present \$1.45 per lb., with the company reporting that "a good volume of sales" should cut this price in half.

GE SILICONE-ALKYDS

In a suggestion that manufacturers who use protective coatings should become better acquainted with silicone resins and oils, General Electric Co. recently made it known that G-E 81182 silicone resin is notable for its wide range of compatibility with a number of paint resins.

The company stated that G-E 81182 in combination with alkyd resins has indicated some very interesting moisture-retarding possibilities. Test panels made from a commercial ready-mix finishing stucco were sprayed with a 5 percent solution consisting of 20 parts of the silicone resin and 80 parts Glyptal-alkyd resin. After aging for two weeks, the panels were immersed in water and weighed daily. The control panel absorbed water to a constant weight in 8 hr. At the end of 7 days, the rate of water absorption of the silicone alkyd panels dropped sharply and at the end of 14 days, the samples had absorbed only 5/6 of the water absorbed by the control.

Stucco panels treated with this silicone-alkyd resin combination, either as a primer under cement paint or as a clear finish coat, also resist formation

of surface checking. However, both untreated controls used in the test were badly checked.

The company suggested that there are many opportunities for the manufacturers who are able to successfully formulate with silicone resins and oils.

Food Preservative

Keeps fish, other fresh foods, up to three times as long. (163A)

Eight years of experimentation have resulted in Fran-Kem, a new preservative to supplement the icing of fish and other fresh foods during shipping and storage.

The new preservative is a powder which can be used in the ice aboard a fishing vessel, in cooking water for crabs or shrimp, or as a dip for vegetables and fruits. Non-toxic, it is composed of equal parts of fumaric acid and sodium benzoate, which halt the enzymatic, oxidative, and bacterial changes not even freezing can totally prevent.

Distribution has begun on a nationwide scale, in containers 25 lb. and larger.

Washington Laboratories, which developed the new preservative, is the second Seattle firm to market a new preservative. The first was Liquid Ice Corp., which markets a product composed of sodium benzoate, chloramine T and sodium chloride.

Dihydroxy Diphenyl Sulfone

Uses: electroplating bath additive, tanning agent resins, stabilizer for cellulose materials. (163B)

Two forms of mixed isomers of dihydroxy diphenyl sulfone are available from the Monsanto Chemical Co. Dihydroxy Diphenyl Sulfone NT, which is the purer of the two mixtures of isomers, is an essentially white, crystalline, free flowing powder having no odor. Dihydroxy Diphenyl Sulfone Crude is a reddish gray, free flowing powder, possessing a slight odor of Phenol. Two of the purified isomers can also be supplied. These are: 4,4'-dihydroxy diphenyl sulfone, and 2,4'-dihydroxy diphenyl sulfone. The 4,4'-isomer is a white crystalline material, while the crystalline 2,4'-isomer is light brown in color.

Uses—(1) Solutions of alkali and alkaline earth salts of dihydroxy diphenyl sulfone may find application because of their buffering actions. (2) The sulfone is useful as an electroplating bath additive. (3) Phenolic resins can be

prepared from it. Such resins, properly solubilized and condensed, have found use as tanning agents, and may be useful as textile auxiliaries, dispersants, fungicides, and bleaching agents.

(4) The sulfone may be used as a stabilizer for cellulosic materials. (5) It has been used in adhesive formulations. (6) The compound and its esters have been found effective as biocides. (7) Dihydroxy diphenyl sulfone may be useful as an intermediate in organic synthesis, particularly in those applications in which a phenolic compound stable to the oxidizing action of light and air would be valuable.

Supply—The NT and crude grades of dihydroxy diphenyl sulfone are available in commercial quantities. The purified isomers can be supplied in experimental amounts.

Ortho-Nitrophenyl

Low-cost, primary plasticizer, compatible with wide range of materials. (163C)

Monsanto Chemical Co. has pointed out that ONB is a possible replacement for many plasticizers which are in short supply because of material scarcities. Most resins, both synthetic and natural, may be plasticized with the material.

ONB is said to be compatible with the cellulose esters and ethers, polyvinyl chloride, polystyrene, polyvinyl butyral, polyvinyl acetate, rosin and rosin esters, modified phenolic resins, alkyd resins and vegetable oils.

The product is particularly recommended for use with polyvinyl acetate adhesives, as a low-cost primary plasticizer for polyvinyl chloride and as a plasticizer for cellulose acetate and cellulose nitrate. In nitrocellulose, the plasticizing action of ONB is similar, and in some cases superior, to that of camphor. It may be substituted for all or part of the camphor in the formula.

The plasticizer also exerts a fungicidal effect.

Furnace Oil Additive

Prevents clogging and rust formation. Disperses condensation. (163D)

Thermisol is the name of a new furnace oil additive developed by Standard of California.

The new additive prevents the clinging together of sub-microscopic particles that tend to gather in furnace oil systems, causing clogging of strainers, screens and filters. Burner parts already clogged are cleared in a short time by the Thermisol-treated

oil. It also tends to disperse water caused by condensation, and to prevent rust formation.



FLEXIBILITY, ADHESION

Plastic Protective Coating

Useful in chemical processing. Can be sprayed on. Air drying. No primer or plasticizer. (163E)

An air-drying plastic protective coating has been developed by the United States Rubber Co. It is used to protect tanks, tank cars, pipes, fittings, structural steel parts and chemical processing equipment against attack by splash, drip and spray from corrosive chemicals, corrosive atmospheres, weathering and rust.

It is expected to find its broadest use in chemical processing, rayon and Cellophane production, photo finishing, pulp and paper manufacturing, sewage disposal, filtering and electroplating and in mining operations. It (Continued)

New This Month . . .

	Page & Item
Silicone-alkyds	162A
Food Preservative	162A
Dihydroxy Diphenyl Sulfone	162B
Ortho-nitrophenyl	163C
Furnace Oil Additive	163D
Plastic Protective Coating	163E
Anti-Static Agent	164A
Battery Additives	164B
Neoprene Protective Coating	166A
Patching Material	167A
Plastic Film Tapes	168A
Quick Drying Enamel	168B
Tallate Driers	170A
Anti-Rheumatic	170B
Powdered Stearic Acids	173C
PVP-Iodine	172A

More Information . . .

To find out more about any of these new products, circle the item's number on Reader Service Postcard inside the back cover.



Where is the safest place to keep your documents?

Are your contracts, blueprints, accounts receivable—the records that keep your business going—really safe?

If you've ever seen business papers charred by fire . . . or made illegible by water from fire fighting, you'll want to make sure it can't happen to your records.

Wherever you store these papers, you can rely on a *Kidde* Fire Extinguishing System to protect them. A *Kidde* System uses carbon dioxide—a gas that won't mark, stain or discolor papers—and it puts out fire *fast*.

You can put a *Kidde* system on guard over one or many record vaults . . . ready at the first sign of flame to release a fire-smothering cloud of CO₂ . . . and do it *automatically*.

Why not go *all the way* in protecting your papers. Call a *Kidde* expert for full information.

Kidde

Walter Kidde & Company, Inc., 428 Main Street, Belleville 9, N. J.
In Canada: Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

New Products, cont. . .

cannot be used in food processing because it imparts a slight odor and taste.

The plastic combines high film flexibility with good adhesion and impact resistance. It will not chip or crack and can be used on steel, aluminum, concrete, hardwood, or composition board. It is applied by spray, allowing 1 hr. drying time between coats and 24 hr. drying time after the final coat. It requires no primer and can be produced in a variety of colors. Since it contains no chemical plasticizer to leach out or harden, it retains its flexibility throughout its service life.

A sharp instrument will cut through the film but the break can be repaired easily by "touching up" with brush or spray. Metal should be grit or sand-blasted before the coating is applied, cement should be etched with hydrochloric acid, while wood and composition board needs rough sanding to assure a good bond.

Coating is in pilot plant production, will be marketed under the trade name, U. S. Royalguard protective coating.

Anti-Static Agent

Will eliminate troubles with static buildup on methyl methacrylate. (164A)

A new anti-static and cleaning agent developed specifically for methyl methacrylate moldings, sheet and other articles is now being manufactured by the Chemical Development Corp., Danvers, Mass. Called Onstac M, it is an inexpensive, easy to apply liquid. The treated product is completely anti-static, thus eliminating the attraction of dust and dirt which spoils the appearance of methyl methacrylate and causes scratches. It is a well known fact that lenses made of this plastic and used with electrical instruments will become sufficiently charged to cause errors in the readings. Also, display cabinets may gradually become cloudy or lose their brilliance because of static dust or dirt. This new development will eliminate these and other troubles caused by static accumulations.

Battery Additives

Don't buy 'em! Bureau of Standards says they're useless. (164B)

Various preparations of liquids and solids are being sold to the public for rejuvenation of worn out or so-called "dead" lead-acid storage batteries. Ex- (Continued)



How Celite Mineral Fillers make a product free-flowing ...



Keeping fertilizers "On the run"

REALIZING their product is one that cannot "cake-up" and still survive in a competitive market, leading producers of fertilizer use one of the Celite Mineral Fillers as a standard "anti-caking" ingredient.

The ability of Celite Fillers to keep a product free-flowing results from their

high absorption properties and unique diatom structure—properties which make them unusually effective safeguards against caking in deliquescent materials. They are two of the unusual physical characteristics that adapt these diatomaceous silica powders to numerous industrial uses.

THESE CELITE PROPERTIES BENEFIT MANY TYPES OF PRODUCTS

Because of their inertness and great bulk per unit of weight, Celite Mineral Fillers make ideal bulking agents for powders and pastes. Their tiny multi-shaped particles interlace to stiffen and strengthen admixtures. The microscopically small facets of these particles diffuse light so effectively that they can be utilized to impart any desired degree of flatness to a surface film. Their light, porous nature improves suspension, helps prevent

segregation. And their porous, thin-walled cellular structure imparts a delicate non-scratching abrasive action.

You may find Celite the "extra something" needed to lift your product above competition. Why not discuss its application to your problem with a Celite engineer? Or write for further information and samples to Johns-Manville, Box 290, New York 16, N. Y. In Canada: 199 Bay St., Toronto, Ont.

CHECK LIST OF PRODUCT BENEFITS OBTAINABLE AT LITTLE COST WITH CELITE MINERAL FILLERS

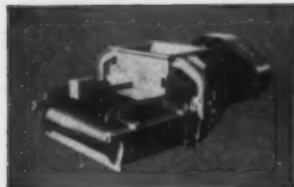
- Added Bulk
- Better Suspension
- Faster Cleaning Action
- Greater Absorption
- Improved Color
- Better Dielectric Properties
- More Durable Finish
- Increased Viscosity
- Elimination of Caking
- Higher Melting Point
- Better Dry Mixing
- Improved Dispersion



Johns-Manville CELITE®

MINERAL FILLERS

If your problem is
FEEDING



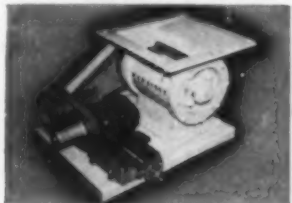
CONSTANT-WEIGHT FEEDERS
Feed by weight—not volume.



WEIGHT-RECORDING FEEDERS
Keep accurate records of weight of material fed.



DISC FEEDERS
Ideal for handling hot, sticky or bulky materials. No bridging—no clogging.



NON-FLOODING VOLUMETRIC FEEDERS
For fine materials, use "rotary pocket" principle.

Write for Bulletin 33-D-11 describing the complete line of Hardinge feeders.

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NEW PRODUCTS, cont. . .

tensive laboratory and field tests have been conducted by the National Bureau of Standards for the Federal Government in order to determine the practicability of these additives. Most of these materials are composed of varying proportions of magnesium sulphate and sodium sulphate. Recent tests at the Bureau have shown little or no difference between batteries treated with these mixtures and similar untreated batteries used as control.

A new circular, *Battery Additives*, just published by the National Bureau of Standards, contains much information on battery additives of interest to the storage battery user.

Neoprene Protective Coating

Where the best types of bituminous or oil-base paints fail in 2-3 yr., this coating will last 5-10 yr. (166A)

Neoprene, the synthetic rubber made by Du Pont, can now be applied as an airdry protective coating for industrial maintenance work on structural steel, concrete, wood and exterior surfaces of tanks and equipment.

It is applied by brush or spray gun in a single coat of 5-10 mils thickness. Outstanding properties are those which distinguish neoprene from natural and other synthetic rubber—exceptional resistance to oil, grease and chemicals; resistance to age-cracking by sunlight, weather and ozone. It also possesses the characteristic properties of any rubber product—resilience, elasticity, high order of abrasion resistance, non-chipping and non-cracking.

The new material is produced by Gates Engineering Co., named Gaco Neoprene Maintenance Coating.

An outstanding feature of the new "airdry" coating is the fact that it develops its desirable physical properties without benefit of heat. It is a solvent solution of a specially developed neoprene composition—it will not gel or "set up" in the container, but will cure at normal temperatures after the solvent has evaporated.

Its field of usefulness, the manufacturer states, will be in applications where intermittent contacts with liquids or constant exposure to corrosive fumes creates protective coating problems too severe for the best types of bituminous or oil-base industrial paints. Under conditions where such paints fail in two or three years, the new coating is expected to have a useful life of five or ten years.

The longer life expectancy of the

new material is based on two properties of neoprene—its well-known chemical stability and its inherent resilience. Its chemical stability is particularly good against the destructive agents to which industrial coatings are exposed, notably attack by chemicals and oxidation by air and sunlight. Its resilience is also advantageous in that it removes the danger of cracking and peeling caused by vibration, distortion, or thermal expansion and contraction of the structure to which the coating is applied. Moreover, because resilience is inherent, the coating is not subject to embrittlement by volatilization or displacement of plasticizer; it contains no plasticizer.

Surface preparation need not include sandblasting or use of a primer, according to tests conducted by Gates. Rusty steel was wire-brushed and wiped clean of grease and dirt, then given a single coat and tested for bond strength. After allowing a short interval for solvent evaporation and air-curing (two to seven days), bond strength was found to be adequate for the coating's intended purpose.

Technical data—Gaco Neoprene contains about 40 percent solids dispersed in aromatic solvents; it can be thinned. Coverage is about 550 sq. ft. per gal. per mil. As it comes from the can, body is sufficiently thick to spray a 10-mil coat without sagging or dripping, and to give good build-up on corners and sharp edges. Mechanical damage is easily repaired.

Price—Base price is \$7.10 per gal.

Patching Material

Resurfaces concrete floors. Finer aggregate fills minute cracks.

(166B)

A armor is the trade-name for a patching material made by the Monroe Co. It is a dry, cement-type powder made up of pulverized pure-oxidizing metal grains and four different kinds of aggregate, chemicals and pozzolanic (setting agent) ingredients. The new aggregates have the approximate sum of 98 percent oxide basilican, iron and aluminum. These combine to produce a surface with unusual resistance to wear, acids, oils, etc.

Unlike new concrete, this product bonds perfectly to old concrete surfaces. It provides a perfectly flush patch when used in areas of any size. Other features include imperviousness to acids, oil, grease and moisture. It is ideal for use in industrial plants of every type. Because of its acid and oil-resisting qualities, it is also widely

(Continued)

On the spot
for low cost

SOLVENTS OR INTERMEDIATES?

try these CHLORINATED COMPOUNDS

	B. P., °C. at 760 mm.	Sp. Gr., 20/20°C.	H ₂ O Sol., % by wt. 20°C.	Flash Point, °F.
Propylene Dichloride <chem>CH3CHClCH2Cl</chem>	96.3	1.1583	0.26	70
Trichlorethane <chem>ClCH2CHCl2</chem>	113.7	1.4432	0.45	None
Dichlorisopropyl Ether <chem>ClCH2(CH2)CHOCH(CH2)CH2Cl</chem>	187.4	1.1135	0.17	185

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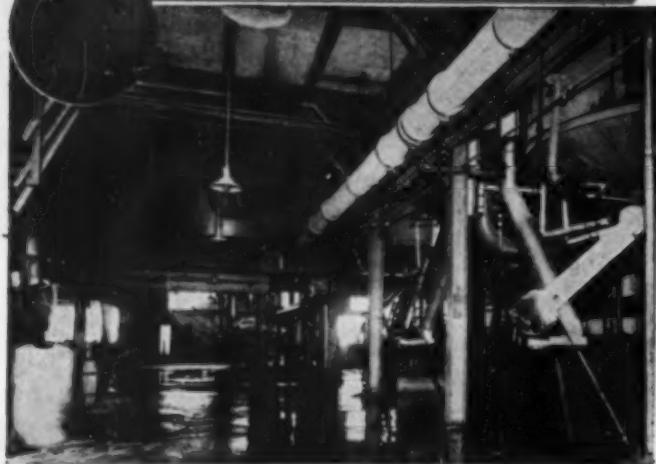


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All three of these chlorinated compounds are powerful solvents for oils, fats, waxes, greases, gums, and resins—just what you need for metal cleaning or solvent extraction. Examples of their uses as intermediates include the synthesis of methyl vinyl chloride from propylene dichloride; vinylidene chloride from trichlorethane; and 2,6-dimethyl morpholine from dichlorisopropyl ether. AND, all three are available in commercial quantities.

Investigate these low-cost chlorinated compounds now. Write for a copy of our "Chlorine Compounds" booklet (Form 4769). If you want to test them, ask for samples.

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"Automatic" Sprinkler Protection is tailored to the Fire Protection requirements of these chemical plants



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Here listed are but a few of the top chemical processing businesses whose personnel, manufacturing operations and business continuity have been safeguarded from fire by "Automatic" Sprinkler:

Allied Chemical & Dye Corporation	Monsanto Chemical Company
Bakelite, Inc.	Pathfinder Chemical Corporation
Barium Reduction Corporation	Pierce & Stevens, Inc.
Buckeye Cotton Oil Company	Pittsburgh Plate Glass Company,
Defender Photo Supply Company	Columbia Chemical Division
Delta Products Company	Procter & Gamble Company
General Tire & Rubber Company	R. B. H. Dispersions, Inc.
Glidden Company	Reilly Tar & Chemical Corp.
Goodyear Tire & Rubber Company	Rohm & Haas
Harshaw Chemical Company	Schenectady Varnish Company
Hercules Powder Company	G. D. Searle Company
Interchemical Corporation	Southern Alkali Corporation
Lever Brothers Company, Inc.	U. S. Industrial Chemicals, Inc.
Minnesota Mining & Mfg. Co.	Witco Chemical Company

Adequate fire protection is essential to the safe and economic operation of chemical plants and—the same is true of all types of industrial, commercial and institutional properties.

Whether your needs call for "Automatic" Sprinklers, CO₂ gas, chemical or mechanical foam, "Automatic" FIRE-FOG, or a combination system of protection, our preliminary engineering service now makes it possible to fairly evaluate the economic and adaptability features of each method, for your own risk.

Let our nearest representative show you how to save lives . . . save property and save money with fire protection by "Automatic" Sprinkler. Literature available upon request.

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YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler

FOR INVESTMENT PROTECTION

DEVELOPMENT • ENGINEERING MANUFACTURE • INSTALLATION
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

New Products, cont. . .

employed in distilleries, breweries, electroplating plants, and the like.

The product is shipped as a dry powder. It can be used by adding water and applying in much the same manner as concrete.

Plastic Film Tapes

For food and chemical packaging.
Low moisture-vapor transmission rate (168A)

Both new tapes—Scotch brand pressure-sensitive tape No. 480 (polyethylene film) and No. 490 (Saran film)—are designed for special packaging and bottle sealing jobs.

The polyethylene tape has a maximum elongation of 700 percent and "excellent" low temperature flexibility. Its backing is resistant to a wide range of solvents.

Though available nationally, the polyethylene tape is available only to firms holding defense contract priorities, the producer pointed out.

It is made in 36-yard rolls, and in widths from $\frac{3}{8}$ - to 22-in. Only transparent is available at the present time.

Saran film tape includes additional advantages such as good sheen, availability in various colors on special order, and conformability with a thin 0.002-in. backing thickness.

It has a moisture-vapor-transmission rate of 0.15 g./100 sq. in./24 hr.

The tape is made in $\frac{1}{4}$ to 18-in. widths, in a 36-yd. roll. It is available through jobbers nationally.

Quick Drying Enamel

For ammunition finishes. Dries hard in 10 min. (168B)

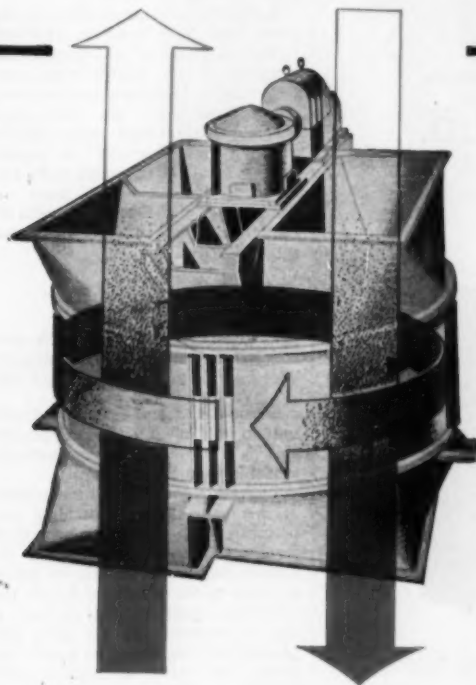
An enamel which dries twice as fast as that previously used for ammunition finishes has been developed by the Paint and Chemical Laboratory at Aberdeen Proving Ground, Md. Based on the use of the new, quick-drying, styrenated-alkyl resins, it is anticipated that this improved rate of dry will speed up production lines on Army ordnance shells, bombs, grenades and other ammunition components.

The new specification, MIL-E-10687 (ORD), indicates that the new enamel will set-to-touch in a maximum of 6 min. and dry hard in 10 min., as compared with an allowable 10 min. for set-to-touch and 30 min. for hard dry, specified for the previously used finish. It is reported that this amazing acceleration in drying speed is accompanied by increased toughness, adhesion, and resistance to

(Continued)

more than 200,000,000 lbs/hr of post-war steam generating capacity

equipped with *Ljungstrom*
AIR PREHEATERS



Here indeed is impressive evidence of the wide acceptance of the Ljungstrom air preheater. Since the war the total capacity of steam generating units equipped with Ljungstrom air preheaters, installed, under construction or on order in industrial and utility plants throughout the country comes to well over 200,000,000 lbs of steam per hr.

The reasons for the steadily increasing preference for the Ljungstrom air preheater are simple enough. The continuous regenerative counterflow principle assures maximum heat transfer with minimum weight and size. Flexible and compact, it may be used in a wide range of applications. Its proven reliability and low maintenance eliminate costly shutdowns.

If you are planning to build a new plant or modernize an old one, investigate the possibilities of the Ljungstrom. The specialized experience of Air Preheater engineers is at your disposal, to aid in effecting the most economic heat recovery from flue gases.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER
60 EAST 42d STREET • NEW YORK 17, NEW YORK
CORPORATION



Bulletin 8210

General Purpose Control Valves

- ★ Full Port Area—Packless
- ★ For Air, Gas, Water, Brine, Freon, Methyl Chloride, Light Oil and other Liquids and Gases up to 215°F; Pressures up to 400 pounds
- ★ Several Auxiliary Variations
- ★ Several Sizes: 1/8 to 2 1/2 inches

Our Bulletin 8210 Solenoid Valves are designed for those shut-off requirements where a simple, rugged, automatic control will serve. They close instantly when current to the coil is cut off. Full line pressure on top of the valve piston aided by a powerful spring assures tight closing. They reopen fully when the coil energy is restored.

Bulletin 8211 Valves are similar except that they have Explosion-Proof Solenoids approved by Underwriters' Inc., Class 1, Group D, Hazardous Location.



If you have any automatic control problems that fit into the above class, study fully the merits of ASCA Bulletin 8210 and 8211 Solenoid Valves. Write us anyway, regardless of your problems, because we have many other types of solenoid valves.

When in need of Electromagnetic Controls, come to us.

Automatic Switch Co.

381 Lakeside Avenue Orange, New Jersey

YOU *will want* THIS BULLETIN



UNION DOWTHERM Vaporizers are built 250,000 BTU/Hr. to 30,000,000 BTU/Hr. at 700°F capacity, to applicable Construction Codes. Fired with fuel, gas or oil or designed for special fuels. Bulletin 124 gives full details on Union DOWTHERM Process Equipment. Write today for this information.

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PROCESS
EQUIPMENT

UNION IRON WORKS
Since 1890
630 CASCADE ST. ERIE, PA.

New Products, cont. . .

salt spray and weathering, for example, while salt spray resistance of at least 150 hr. is required, test panels exposed for over 250 hr. in the Aberdeen labs have shown negligible failure.

Tallate Driers

Naphthenate substitutes vastly improved, can be substituted in most formulations. (170A)

New, high quality tallate driers have been developed by Witco Chemical Co. under the trade name Witalts. The company states that the new driers are not to be considered solely as substitutes for naphthenates, but as quality driers in their own right. Tallates were used as substitutes for naphthenates during World War II, but have been much improved by better raw materials and more expert manufacturing procedures.

The driers combine excellent drying power and light color in uniform, controlled products, according to the company. Their reliable metal content, stability to storage, freedom from objectionable odor, and wide range of compatibility with paint vehicles assure their acceptance as regular driers comparable to naphthenates and octoates. Though slightly more viscous than naphthenates, in almost all formulations they can be substituted pound for pound.

Anti-Rheumatic

Chemical relative of salicylic acid may be the answer to childhood's scourge, rheumatic fever. (170B)

Gensalate Sodium, brand of the sodium salt of 2,5-dihydroxybenzoic acid is a new prescription specialty available from Panray Corp.

Increasingly useful in the treatment of rheumatic diseases, the drug acts promptly and effectively to reduce fever, pain, swelling and other abnormal symptoms. In this, its action is similar to the salicylates. Unlike the salicylates, however, the product is almost non-toxic. In the doses employed, the drug causes no gastric irritation, or other undesirable side effects.

Powdered Stearic Acids

Stearic acids in a new "extra fine" powdered form are now available from Emery Industries Inc. The company says these new powders represent the finest particle size stearic acids available. (170C)

(Continued)

MOTOR WHEEL CORPORATION

LANSING 3

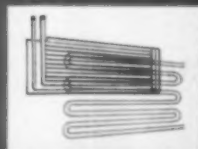


MICHIGAN

finds PLATECOILS more efficient - require 90% less cleaning

The advantages of Platecoils for tank heating and cooling make themselves felt in many ways. An example is the Motor Wheel Corporation, where Platecoils have replaced pipe coils for heating a bonderite washer. Mr. C. V. Lovell, Chief Draftsman, Maintenance Department, says Platecoils "are more efficient for the following reasons: "First, the scale formed by the solution does not adhere as readily to the smooth surface of the Platecoils and secondly, a large percentage of the scale that does collect is flaked off. Naturally this allows the Platecoil to be a better heat conductor . . ."

HOWEVER, THE GREATEST SAVING seems to be in the amount of time consumed in cleaning the coils. The pipe coils were cleaned every thirty days by the hammer and chisel method and required about five man hours per coil, including removal and replacement time. The Platecoils are cleaned by brushing every sixty days and require about one man hour per coil including removal and replacement time. In terms of dollars and cents this amounts to a saving of approximately \$7.20 per coil per month . . .



A 12" x 12" Platecoil, 10' long, weighs only 10 lbs. and has a capacity of 12 ft. of 12" pipe, or a value only about 10% the same space.



Write today for Bulletin No. P-61.

PLATECOIL gives you these ADVANTAGES

- ✓ Cleaned and Repaired Without Dumping Tank Solution
- ✓ Greater BTU Transfer Per Unit Area
- ✓ Weighs Only Half as Much as Pipe Coil
- ✓ No Threaded Joints in Tank
- ✓ Increased Tank Capacity
- ✓ Fast, Easy Installation
- ✓ Easy to Clean

PLATECOIL

Division

KOLD-HOLD MFG. CO.

LANSING 4, MICHIGAN

NEW PRODUCTS, CONT. . .

PVP-Iodine

Polyvinylpyrrolidone. Renders iodine non-toxic. Tests to date indicate it is a remarkably safe and effective virus-killer. Made by General Aniline & Film Corp. (172A)

Called PVP-iodine, the substance combines iodine with polyvinylpyrrolidone. The latter chemical has been in the news in the past few months because, based on its use by the Germans during World War II, it is known to be a superior substitute for blood plasma.

In combination with iodine, PVP acts as a detoxifier without destroying its high efficiency as a virucide or germicide. Physicians have known for many years that iodine possesses most of the qualities needed to combat a variety of germs and especially viruses, but its high toxicity when taken into the system, prevented its use. Even its external applications have been reduced because it is a strong irritant and often results in severe burns. Tests to date, though not conclusive, have been most encouraging.

During 18 months of testing at the Philadelphia General Hospital, successful results have been obtained in the treatment of more than 100 skin infection cases of varying severity—cases which had failed to respond to conventional treatment. Other patients with systemic infections such as grippe and colds have shown rapid, marked improvement under the PVP-iodine treatment. No harmful side effects were observed in any of the cases.

Summarizing the effects of tests with the new drug:

1. PVP-iodine was more effective than iodine alone in treating bacterial infections because of a longer duration of effect.

2. PVP-iodine is virtually non-irritating and therefore the scope of its use is much greater. It can be used on all tissues, internal and external, without danger of burn or intense irritation.

3. The toxicity of the iodine in PVP-iodine has been greatly diminished so that it may be given orally or intravenously in therapeutic doses without undesirable side effects. The maximum limit has not yet been established for intravenous use in human beings.

4. No iodine sensitivity produced by the PVP-iodine was noted in the entire series of cases. Furthermore, iodine-sensitive people did not react to PVP-iodine.

—End

Girdler helps make it all sweet



... AT
SWIFT AND COMPANY



VOTATOR Processing Apparatus

FINE INGREDIENTS are the starting point for any fine food product, such as Swift's Allsweet oleomargarine. But from there on, a lot can happen . . .

For instance, if margarine is produced in "batches" it's difficult to maintain uniformity. That's why Swift & Company uses modern continuous processing—with Girdler's VOTATOR Processing Apparatus.

With this equipment, Allsweet's fine ingredients flow through a totally enclosed system under precise automatic control. Purity is safeguarded, and *product uniformity assured*. Thus VOTATOR Processing Apparatus helps to keep Allsweet just what the name implies.

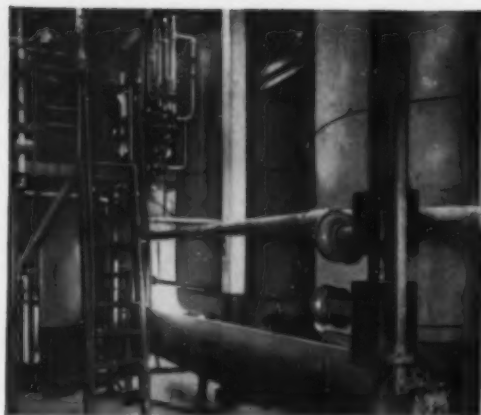
The complete processing operation is performed in a matter of *seconds*—where batch methods

take hours!

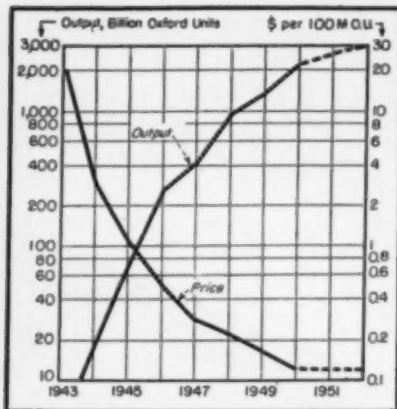
There's a word to the wise here for you, if you process any liquid or viscous materials. Investigate the amazing benefits of VOTATOR Processing Apparatus for cooking, cooling, sterilizing, plasticizing, quick-freezing, pasteurizing or aerating. Write or call The Girdler Corporation, Votator Division, Louisville 1, Kentucky.

VOTATOR T.M. Reg. U.S. Pat. Off.

GIRDLER CORPORATION
Louisville 1, Kentucky

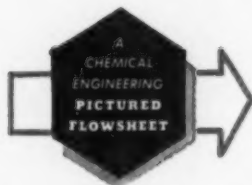


Huge production fermenters yield crude broth for Cutter.



Price has fallen as output has grown.

Penicillin



In the past six years yields have grown twenty times.
Here is one of the units that made this possible.

Only
plant
in West

Cutter Laboratories is the sole producer of penicillin west of the Mississippi. Among the initial producers of this most important of the antibiotics, Cutter has made substantial improvements in process and increases in capacity in the last few years.

Ferment
in deep
tanks

A special strain of *Penicillium Chrysogenum*, developed by Cutter from a parent strain from the University of Wisconsin, is grown on media whose main constituents are corn steep liquor and lactose, in 5,000-gal. fermenters. Small seed tanks are inoculated with spores, and the mycelia grown in these seed tanks is then introduced into sterile media in the production fermenters. The mass is agitated throughout the growth cycle and sterile air is added to support the metabolism of the mold.

Filter
out
solids

When the penicillin concentration in the fermenters reaches the optimum the tank is opened. Crude broth is cooled rapidly to reduce the degradation of the relatively unstable penicillin, and the liquor is clarified by filtering out the mycelia and other solids by means of a rotary vacuum filter.

Extract,
add carbon
and filter

The penicillin is purified and extracted from the clear broth through a three-stage solvent extraction process. The pH of the broth is adjusted with acid and the penicillin is transferred into solvent in a Podbielniak centrifugal solvent extractor. The solvent phase is treated with activated carbon, filtered and the penicillin

extracted into an aqueous buffer solution, again using a Podbielniak extractor. The final extraction into solvent is carried out in a tank, batchwise, and is followed by conversion of the penicillin into either crystals of potassium penicillin or procaine penicillin. The bulk crystals are dried and then tested.

Extract
and get
crystals

The pharmaceutical preparation of penicillin is a function of the end product desired. The steps through which it may pass include grinding, granulating, blending, and mixing with other ingredients. Cutter currently manufactures suspension of procaine penicillin in oil or water, procaine penicillin powder which may be suspended by the doctor immediately prior to administration, water soluble penicillin, and a variety of troches and tablets. Since all products but tablets and troches are for parenteral use, processing and packaging must be carried out under sterile conditions and comprehensive tests, both biological and chemical are made on all lots.

Mix,
grind and
blend

Present Cutter penicillin equipment is being used to capacity and plans are under way to expand production by adding additional facilities. Cutter is continuing active research and development on all phases of penicillin production, including a search for new and improved strains. A pilot plant is evaluating new strains developed by the research departments and carrying on a process development.

More
to
come

**pipng maintenance
costs more
now!**

**You do less of it
by using Dependable Quality
CRANE VALVES**

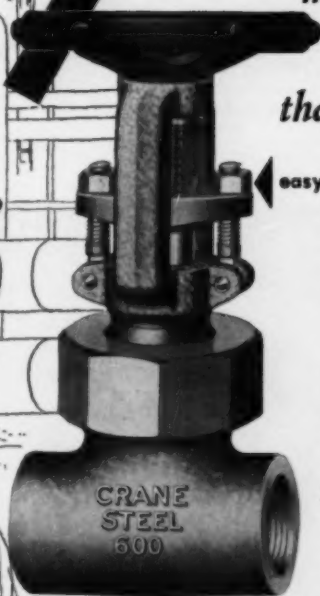
*...That's why
more Crane Valves
are used
than any other make*

easy to use...easy to keep on the job

You'll have much less valve maintenance wherever you install Crane 600-Pound Small Steel Gates. Use with recommended trim on oil or oil vapor, steam, water, air, or gas.

Compact yet rugged—light yet strong—these are truly small steel valves with big valve features. They sacrifice nothing that insures dependability and tight seating, easy operation, and convenience in keeping them in top-notch working condition.

Supplied in sizes 2 inches and smaller, No. 3602 valves are engineered to the standards that make Crane Quality your best choice in valves of every type.

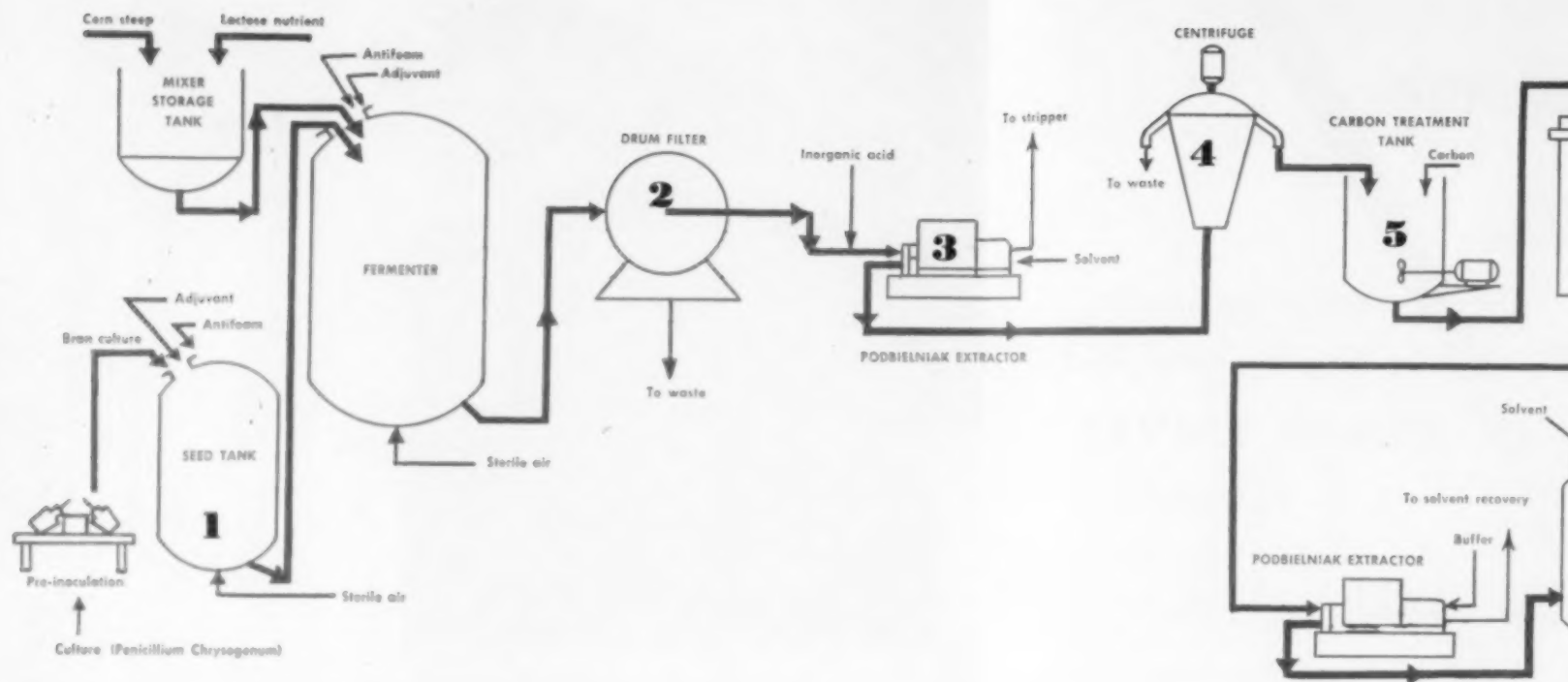


No. 3602 Small Steel Gate Valve

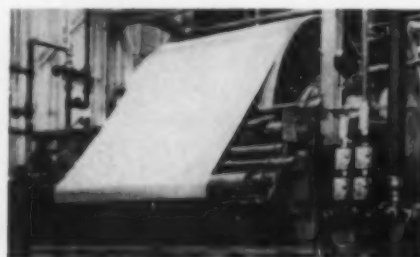
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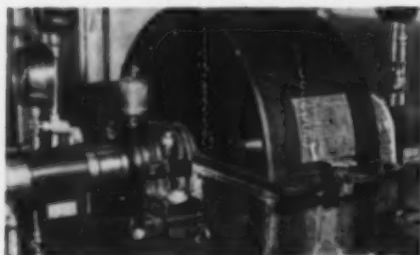
VALVES • FITTINGS • PIPE • PLUMBING • HEATING



1 SEED TANKS like this unit are charged with a bran culture, adjuvant and an antifoam agent.



2 ROTARY FILTER removes mycelia and other solids from penicillin broth leaving fermenter.



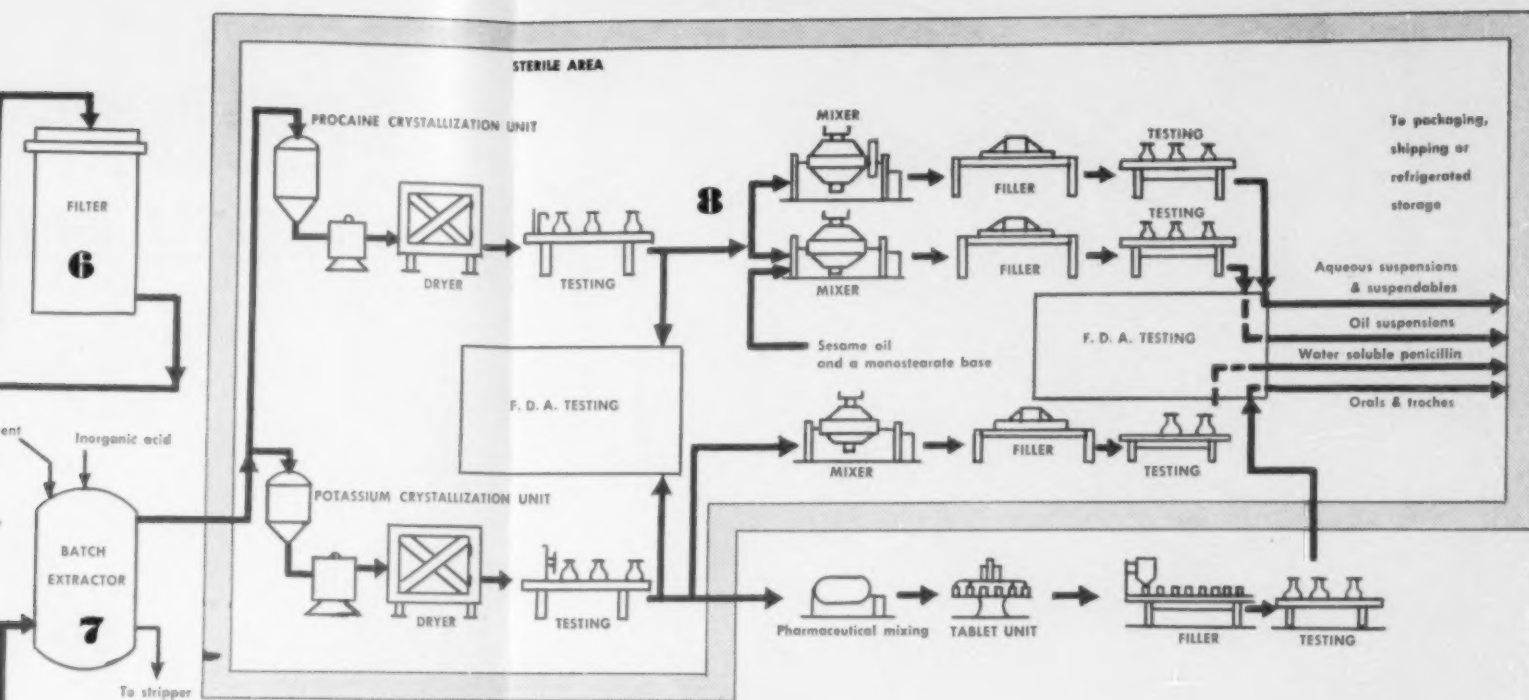
3 PODBIELNIAK EXTRACTOR transfers the penicillin to a solvent, acid adjusts pH.



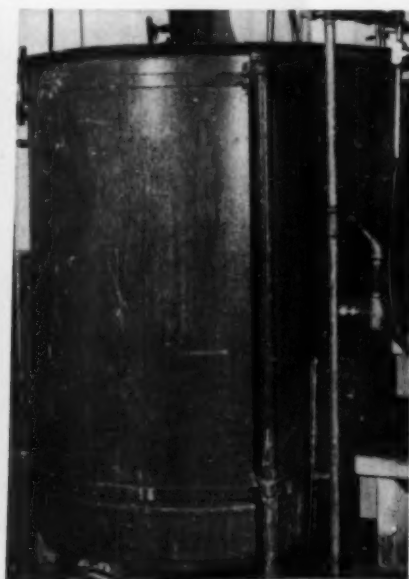
4, 5 CARBON TANK where activated carbon treats centrifuged solution.



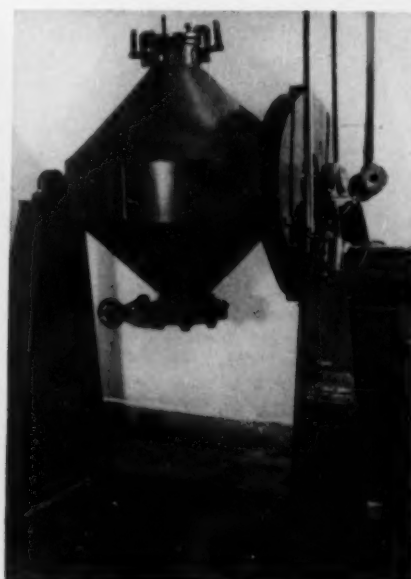
6 FILTER removes activated carbon traction of penicillin into buffer



and carbon prior to ex-
buffer solution.



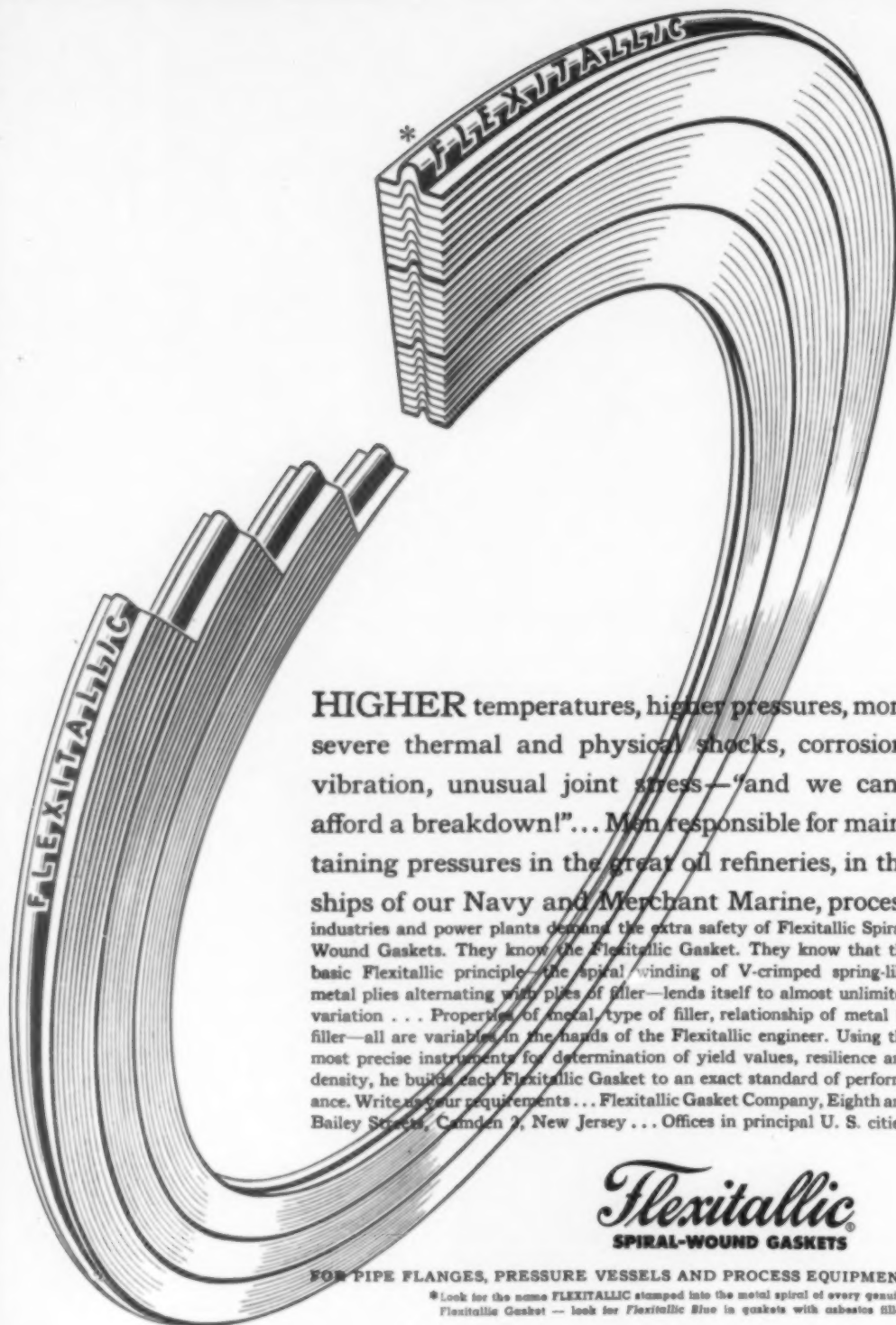
7 BATCH EXTRACTOR carries out final extrac-
tion. Crystallization and drying follow.



8 ROTARY MIXERS are used in the pharma-
ceutical production of these penicillin products.



TESTING is a vital part of the operation. These
tests are made by both Cutter and the F. D. A.

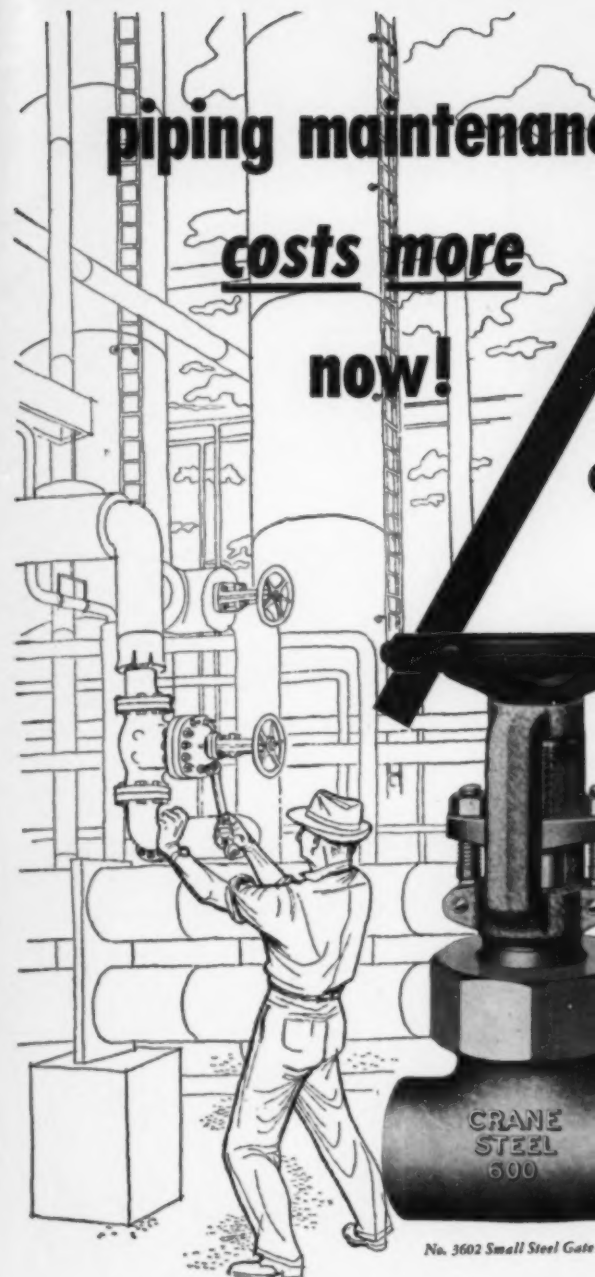


HIGHER temperatures, higher pressures, more severe thermal and physical shocks, corrosion, vibration, unusual joint stress—"and we can't afford a breakdown!"... Men responsible for maintaining pressures in the great oil refineries, in the ships of our Navy and Merchant Marine, process industries and power plants demand the extra safety of Flexitallic Spiral-Wound Gaskets. They know the Flexitallic Gasket. They know that the basic Flexitallic principle—the spiral winding of V-crimped spring-like metal plies alternating with plies of filler—lends itself to almost unlimited variation . . . Properties of metal, type of filler, relationship of metal to filler—all are variables in the hands of the Flexitallic engineer. Using the most precise instruments for determination of yield values, resilience and density, he builds each Flexitallic Gasket to an exact standard of performance. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey . . . Offices in principal U. S. cities.

Flexitallic
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket — look for Flexitallic Blue in gaskets with asbestos filler.



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costs more
now!**

CRANE

VALVES • FITTINGS • PIPE •

CHEMICAL ENGINEERING—April 1951

nce

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by using Dependable Quality
CRANE VALVES**

*...That's why
more Crane Valves
are used
than any other make*

easy to use...easy to keep on the job

You'll have much less valve maintenance wherever you install Crane 600-Pound Small Steel Gates. Use with recommended trim on oil or oil vapor, steam, water, air, or gas.

Compact yet rugged—light yet strong—these are truly small steel valves with big valve features. They sacrifice nothing that insures dependability and tight seating, easy operation, and convenience in keeping them in top-notch working condition.

Supplied in sizes 2 inches and smaller, No. 3602 valves are engineered to the standards that make Crane Quality your best choice in valves of every type.

Gate Valve

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**MANY APPLICATIONS
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CATALOG NO. 67**
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Here is a compact, self-contained grinding unit for continuous processing of materials from feed hopper to finish bin. The whizzer separator gives close product control. Changes in fineness are made by one simple adjustment.

The wide adaptability of the Raymond whizzer-type Imp Mill makes it a highly efficient and practical unit for producing the many different types and grades of powdered materials in the chemical and food industries.

The Imp Mill delivers a uniform finished product to meet exacting specifications and gives superior results on many unusual operations such as disintegrating and drying filter-cakes, blending pigments, and handling heat sensitive materials which require a cool operating mill.

If you have a special production problem, let Raymond engineers advise you on the most economical type of mill for your purpose.

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PULVERIZER DIVISION

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costs more
now!**

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by using Dependable Quality
CRANE VALVES**

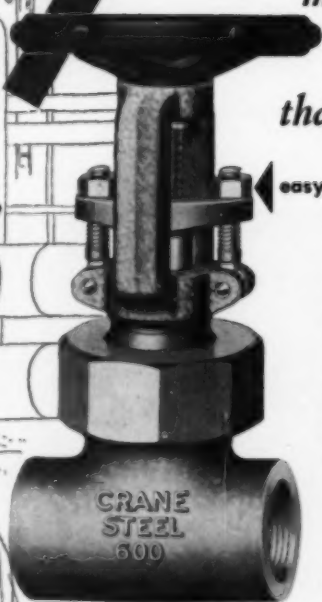
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No. 3602 Small Steel Gate Valve

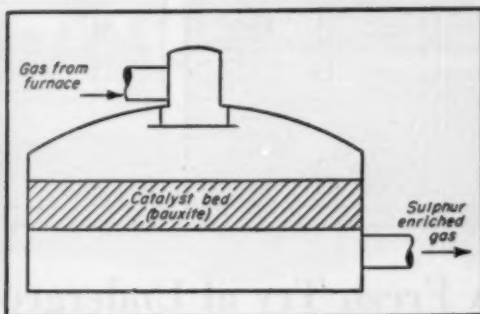
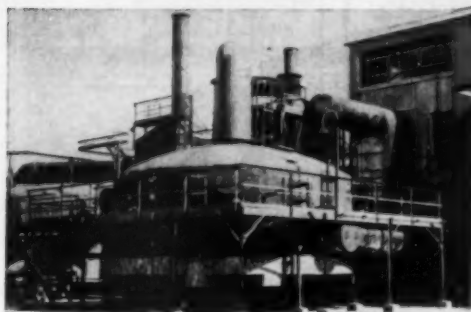
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VALVES • FITTINGS • PIPE • PLUMBING • HEATING

CHEMICAL ENGINEERING—April 1951

179



Converter Gets Sulphur From Sour Gas

First large unit of its kind in this country, the giant sulphur recovery plant of Texas Gulf Sulphur Co. at Worland, Wyo., is already getting over 300 long tons per day of sulphur from sour natural gas.

This is the first volume production of sulphur by Texas Gulf other than from the salt domes of Texas. The new method results from continuing efforts by the company to develop U. S. sulphur resources.

Main units of the new plant are (1) the monoethanolamine absorption unit for removing hydrogen sulphide from sour natural gas and (2) the catalytic unit for converting hydrogen sulphide to sulphur. Designed by Foster Wheeler Corp., the catalytic converter unit includes waste heat boilers and heat economizers.

Hydrogen sulphide acid gas from the monoethanolamine absorption unit is charged to the reactor furnace of the sulphur recovery plant. The theoretical reaction in the furnace is that of hydrogen sulphide with oxygen to produce water vapor and sulphur. Actually, exit gases from the furnace include hydrogen sulphide, sulphur dioxide, sulphur, carbon dioxide and nitrogen. All these are charged to the catalytic converter (see cuts).

The converter uses a bauxite catalyst to react hydrogen sulphide with sulphur dioxide to produce water vapor and elemental sulphur. The other gases go through as inerts. In essence, then, the process consists of controlled combustion followed by catalytic conversion.

Sulphur is piped directly to stockpiles in a molten state. Recovery is virtually complete, since only a frac-

tion of 1 percent of the sulphur is lost.

The Worland plant is designed to process 30 million cubic feet of gas per day. Sour natural gas, containing 30 percent hydrogen sulphide and some carbon dioxide, is piped to the sulphur plant from all wells in the oil field of Pure Oil Co., 6 mi. north.

After removal of hydrogen sulphide, the sweet gas is sent to the plant of Pure Oil, where liquid petroleum products are removed. The final result is a natural gas equivalent in every way to sweet natural gas. Part is burned by Pure Oil and Texas Gulf as fuel; the rest is available for domestic and industrial use in the area.

Under centralized management, the entire Worland field has just been unitized. This insures that production

of oil and gas, as well as sulphur, will be regulated to give maximum yields. What's more, it will reduce the daily natural gas production to a quantity that will not exceed the capacity of the sulphur recovery plant.

Reserves of sulphur at Worland are estimated to exceed 3 million long tons. At the present rate of production the field may last over 25 years.

Sulphur from Worland can be shipped via rail to all parts of the West and as far east as Chicago.

By engineering the recovery of sulphur from the sour gas fields of this Wyoming area, Texas Gulf Sulphur thus materially adds to the country's reserves of sulphur and helps to brake the depletion of this valuable element.

(News continued on next page)

LITTLE BONERS



A Piece of Ash

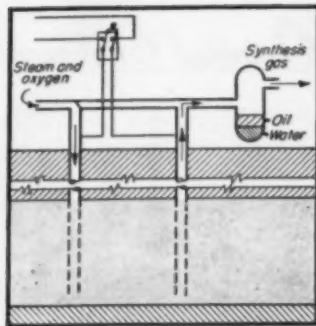
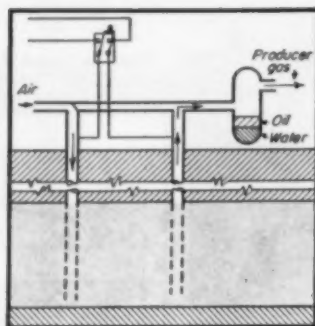
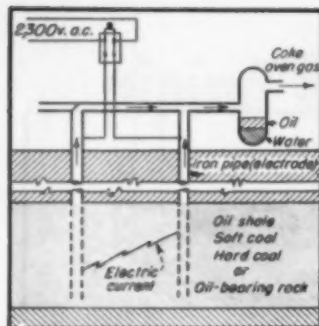
Shipment of two carload lots of high-grade crystals had been held up for three days. The product didn't meet the low-

ash requirements the customer insisted on. The customer was saving—after all, didn't they promise delivery on Tuesday? The plant foreman was in a stew—such a thing had never happened before. In the entire plant only the analytical chemist fresh from school, was confident—he had followed the routine procedure to a T.

Did he sample properly? Were the beakers spotless? Were the Gooches clean? Did he make a mistake in weighing?

"Everything was perfectly clean. The Gooches were brand new. Oh, there was a little excelsior in them, but wouldn't it burn off anyway?"

That little piece of excelsior cost the company almost \$1,000. But the young chemist never forgets the lesson; he later made good. Why not send in your own favorite "Little Boner" to the Editor, *Chemical Engineering*, 310 W. 42nd St., New York 36, N. Y.?



A Fresh Try at Underground Gasification

A new method of underground coal gasification uses an electric current to form a channel in the coal seam through which air is passed for gasification. Vertical steel pipes act as electrodes. Gas is removed through these same pipes, which also admit air for the gasification. A high-Btu. coal gas and a low-Btu. producer gas are formed. Product gases can be used for combustion and in gas turbines. It is also possible to produce synthesis gas.

Sinclair Coal Co. and the Missouri School of Mines pioneered this electrocarbonization method; the Bureau of Mines plans to use it in new experiments at Gorgas, Ala. Sinclair and the Missouri School of Mines have put the technique through its paces at a test installation at Hume, Mo. A 2-ft. seam of high-volatile bituminous coal, 30 ft. underground, was successfully tapped.

As demonstrated at Hume, the process takes place in two stages: (1) carbonization by electrical resistance, producing coal gas and opening up the channel; and (2) gasification of the remaining underground coke bed by forcing air down to the incandescent coke, forming producer gas.

Coal is carbonized by passing an electric current between electrodes buried in the coal. Four electrodes are arranged in a straight line at 30-ft. intervals, making a total distance of 90 ft. They are 54-in. stainless steel pipe, perforated so gas can pass inside and up to the surface.

Initial voltage is 2,300 v., which diminishes as the current passes across the 90-ft. path. From one electrode to another—a distance of 30 ft.—400 v. seems to be adequate for effective carbonization. The voltage must be cut down as carbonization proceeds, since resistance decreases.

Electrical conductivity of the coal is due mostly to moisture in the seam. Thus the path of the current between electrodes is an unpredictable line of best conductivity. Generally, the coked area between two electrodes is in the shape of an ellipse.

Heated by its own resistance to electricity, the coal carbonizes. Volatile substances are driven off and pass up through the perforated electrodes and boreholes. The gas becomes visible at the surface about 5 min. after the current is turned on; peak output is reached an hour or so later.

Carbonization leaves a hot permeable coke bed that can be ignited by passing air through it as much as two days after carbonization has been stopped. Air for igniting the coke is forced down at 15 psi. by a 210-cfm. compressor. The producer gas formed is forced up through the pipe electrodes, now inactive, and the boreholes. Though neither oxygen nor steam has yet been used instead of air, either would boost gas quality.

In the present stage of development, about 4,000 cu. ft. of 600-Btu. gas per ton of coal is produced by carbonization. Bigger volumes of high-Btu. gas could be made by using higher voltage and amperage and higher temperatures. The rest of the heating value in the coal is converted to producer gas. With the compressor now in use, 3,600 lb. of coal can be gasified in 24 hr.

During the electrocarbonization stage a gas of 500 to 650 Btu. per cu. ft. is given off. This contains about 15 percent methane and other hydrocarbons, 50 percent hydrogen, 15 to 18 percent carbon monoxide, 6 to 8 percent carbon dioxide, plus hydrogen sulphide and tar vapors, at a carbonizing temperature of 1,472 to 1,652 deg. F.

Gasification with air yields a producer gas of 120 to 150 Btu. per cu. ft. The yield and richness of total gas will, of course, depend upon the proportion of coal gas resulting from electrical carbonization and of producer gas made by gasification with air.

More Coal Chemicals to Come From Colorado Coke Ovens

A battery of 41 Koppers-Becker low differential coke ovens at the Pueblo, Colo., steel mill of Colorado Fuel & Iron Corp. is being rebuilt to increase its capacity for production of coke and byproduct chemicals. The battery was slated to go back into operation early in April.

As a result of the rebuilding, coke capacity will be increased from 2,700 tons per day to 3,000 tons. There will be a proportionate increase in byproduct chemicals.

The ovens produce ammonium sulphate, benzene, creosote, crude solvent, naphthalene, pyridine, tar, toluene and xylene. No additional refined or new products will be produced in the immediate future. Some of these products, notably benzene, are being allocated to customers.

The coke-oven program is based primarily on plans to increase the steel capacity at Pueblo by 325,000 tons annually to a new level of 1.7 million tons. The \$26 million over-all program should be completed by 1952.

Lathrop Sees Profits in Byproducts of Sugar Mills

Operators of sugar mills in Louisiana and Florida can add to their profits if they will: (1) separate pith and fiber from the fresh bagasse at

(Continued)

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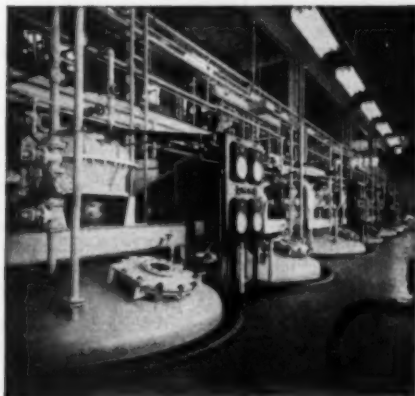
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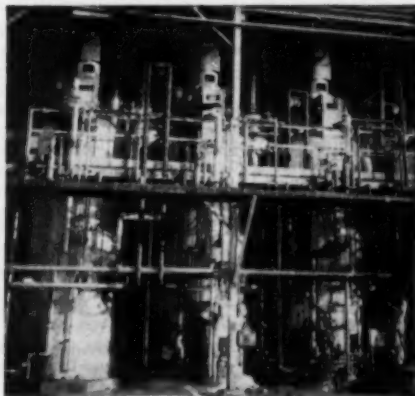
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the mills; (2) dry the fiber and sell it to paper mills for making pulp to blend with wood pulps; and (3) absorb the byproduct blackstrap molasses on the dried pith and sell the mixture as an ingredient for livestock feed.

The separation method could offset rising operating costs and increase profits of the mills, says Dr. E. C. Lathrop of the Northern Regional Research Laboratory of the U. S. Department of Agriculture at Peoria, Ill., where the development work on this enterprise was carried out. Lathrop was for several years director of research and vice president of the Celotex Corp. He emphasizes that maximum profit from byproducts would result only if the sugar industry undertook the recovery problem itself instead of letting others tackle it.

While good corrugating board can be made from either fresh or stored whole bagasse, Lathrop points out, the pith-free fiber is considerably better. On the other hand, pulps for high-grade paper cannot be made from whole bagasse. But pulps made from bagasse from which the pith has been removed are valuable for blending with pine pulps for such purposes.

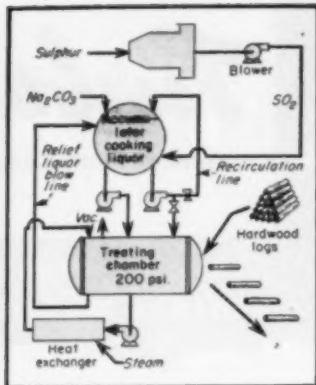
Byproducts might return a profit of \$1 or more on each ton of cane ground, according to Lathrop. This is more than what sugar mills are now getting for the bagasse either as fuel or for other uses. What's more, combined uses cannot consume the large tonnage of bagasse produced.

Socony Licenses Blaw-Knox To Build Cat Crackers

Chemical Plants Division of Blaw-Knox Co. has been authorized under the licensing program of Socony-Vacuum Oil Co. to design and build catalytic cracking plants using Socony's patented processes.

Included in these processes is Thermofor Catalytic Cracking, a modern development in oil refining designed to enable octane improvement and higher yields. Recent Socony-Vacuum refinements, such as the development of a synthetic catalyst, an improved reactor and an air lift for movement of the pelleted catalyst, are said to simplify plant requirements and increase the benefits of cracking from lower-grade crude petroleum.

Blaw-Knox specializes in the engineering and construction of process plants and equipment. It will embody the patented processes in plant designs tailored to meet individual needs of refiners, based on pilot-plant studies of specific oil stocks.



Chemical Treatment Softens Hardwoods

Key to the new chemigroundwood process for converting hardwoods into mechanical pulp is a mild chemical pretreatment of the logs. Three pilot plants, each producing around 25 tons a day, are now being operated. At least one company has made a cost estimate on a commercial plant.

The process was developed at the College of Forestry of the State University of New York at Syracuse. Co-sponsor of the research is the Empire State Paper Research Associates, Inc., a group of pulp and paper manufacturers. The project has been jointly financed by ESPRA and the state of New York.

Hardwoods are fast becoming an important source of wood pulp as stands of softwoods dwindle and demand for paper grows. Up to now, both mechanical and chemical pulping have worked better with the softwoods of northern spruce or southern pine than with such second-growth hardwoods as birch, maple and beech.

Now, despite their shorter fibers, hardwoods of the northeastern United States and Canada can be treated by the new chemigroundwood process to produce pulps equaling or surpassing that from spruce.

Whole 4-ft. logs are prepared for grinding by a 6-hr. treatment in hot neutral sulphite liquor. An initial vacuum for 30 min. aids penetration of the liquor into the wood. Then a pressure of 200 psi. is applied and the logs are soaked in the liquor at 302 deg. F. The liquor contains 6 parts sodium sulphite to 1 part sodium bicarbonate; this gives pulps with the greatest strength. The pH of the cooking liquor changes from about 9.5 at the beginning to 9.3 at the end of the 6-hr. treatment. After this softening,

the wood is ground in conventional mechanical pulping equipment to give a high yield of pulp.

Treating liquor can be used over and over in successive cooks. This amounts to a chemical recovery of 80-85 percent.

Cooking liquor is made by burning sulphur and bubbling the hot sulphur dioxide into a soda ash solution, thus conserving heat. Since neutral sulphite liquor is relatively non-corrosive, one unlined iron or steel tank can be used for making the pulping liquor and another, preferably horizontal, for treating the hardwood logs.

Chemigroundwood pulps can be bleached with sodium peroxide or hydrogen peroxide using the same processes employed in bleaching softwoods. They bleach to a whiteness comparing favorably with ordinary bleached groundwood.

The new vacuum-pressure treatment cuts power requirements, increases the production rate and gives pulp of greater strength and usefulness. Power consumption is reduced by half, with twice the production rate of ordinary groundwood. Pulps are three to four times as strong as ordinary spruce groundwood.

Mill tests indicate that the pulp can be used in newsprint, tissues, some book papers, and types of paperboard. Paper napkins from the pulp have been tested in retail markets.

Because of the high yield from hardwoods (which are cheaper than spruce by the cord and also heavier) the production cost of pulp from the chemigroundwood process is about \$35 a ton; this compares with a current price of \$85-\$100 per ton for spruce groundwood.

(News continued p. 186)

Southwest Success Story



Today's high-speed civilization plus the reorganization of the Army and Navy for war has put ever-increasing demands on the petroleum processing industry. The oil companies of America have continued to build and expand facilities for producing more and more petroleum products. Today more petroleum is produced and processed in the great Southwest than in any other area in the world.

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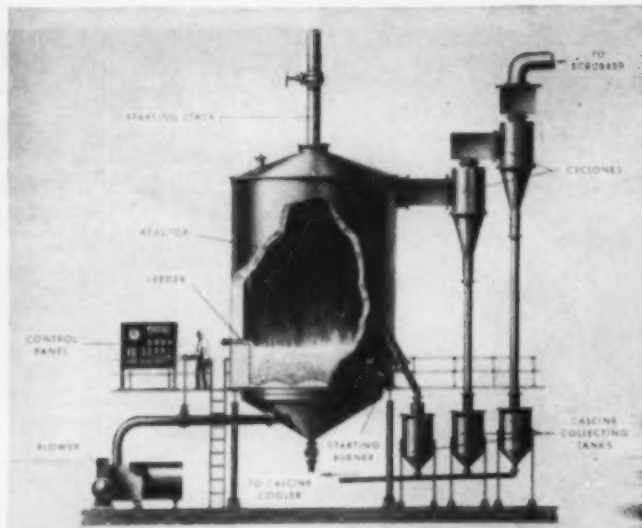
ably proud of its contribution to the petroleum industry and other industries in this part of the country. Brown & Root offers experienced counsel backed by more than thirty years of successful engineering and construction in the Southwest. A complete knowledge of soil, terrain, people, and climatic conditions will result in faster, more economical completion of any contemplated project. A request from you will put Brown & Root consultants at your service; at no obligation to you.



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Another Way to Get Sulphur Dioxide

Producers of sulphuric acid and users of sulphur dioxide can now tap an alternate source of SO_2 . The Dorr Co.'s FluoSolids system can be applied to the roasting of iron pyrite or zinc or copper sulphides for the production of SO_2 gas.

Either unground pyrite or pyrrhotite flotation concentrate or massive pyrite or pyrrhotite crushed to pass approximately 14 mesh, may be self-roasted by FluoSolids. There are no moving parts within an FS reactor. And Dorr claims lower investment and operating costs than with conventional roasting methods.

When roasting 48 percent sulphur pyrite at 1,652 deg. F. with a minimum of excess air, gas strengths up to 14 to 15 percent SO_2 are obtained; a maximum of 14 percent total sulphur is left in the calcine. Under these conditions, SO_2 formation is kept to a minimum. With pyrrhotite, gas strength will be up to 12 to 13 percent SO_2 , depending upon the analysis of the raw material.

Pyrite or pyrrhotite feed may be introduced substantially dry or as a slurry repulped to about 80 percent solids, depending upon local conditions. Calcine can be quenched in water for sluicing to waste or process, or caught dry and cooled to handling temperature.

Roasting temperatures are accurately controlled (1) to avoid sintering and (2) to minimize formation of fer-

rites or base metals if present. If the calcine is to be used for steel making, any amount of sulphur can be left in the calcine to act as sinter fuel. Or if the copper or zinc content is too high for steel making, the roast can be conducted so as to sulphate the copper and zinc; these metals can then be leached out to meet required specifications.

Pennsalt Develops Process For Blending DDT and BHC

A new process for the uniform impregnation of DDT-benzene hexachloride dusts has been developed by Pennsylvania Salt Manufacturing Co. It's now in use at Pennsalt's new insecticide formulating plant at Montgomery, Ala., and in the plants of formulators who use Pennsalt's technical DDT and 36 percent gamma isomer BHC.

The process is based on the fact that when technical DDT and 36 percent gamma isomer BHC are blended in a certain proportion, the combination has a lower melting or setting point than either of the two melted separately. The resulting liquid can be blended with diluent so that virtually every particle carries some of the active ingredient, in contrast with mechanical mixtures wherein particles of the diluent remain inactive.

Fortunately, the relative proportions of BHC and DDT producing the desired low melting point are quite near the proportions required for commonly used insecticide dusts such as 3-5-0 (3 percent gamma isomer BHC, 5 percent DDT and the balance diluent) and 3-5-40 (same as 3-5-0 with 40 percent sulphur).

A quantity of 36 percent gamma isomer benzene hexachloride is first melted in a vessel equipped with a steam coil or jacket. The correct proportion of DDT is then added and melted in with mild stirring. The molten mix, containing approximately

(Continued)



DU PONT'S NEW EXPERIMENTAL STATION

Du Pont will unveil its new \$30 million addition to its Experimental Station in Wilmington, Del., during dedication ceremonies May 10. Twenty-seven buildings, in all, were erected, some in the older area of the station on Brandywine Creek and others on the new 55-acre adjoining section. The station is Du Pont's biggest single research center. Even so, it employs less than half of the company's total research personnel. Buildings are of both steel frame and reinforced concrete, with red brick finish. They house the latest in laboratory equipment, some of it original, and all of it designed for safe and effective research.

WELDER

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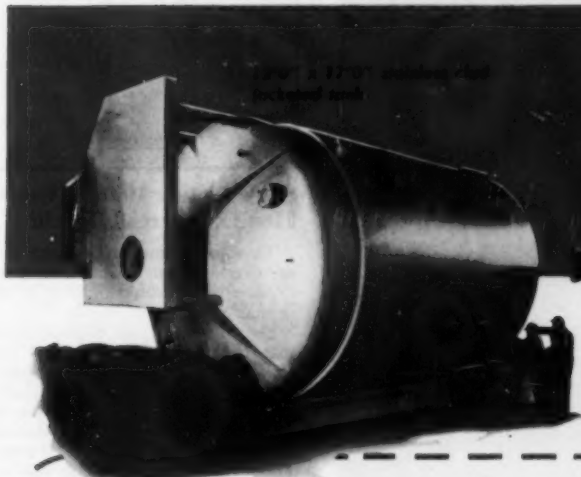
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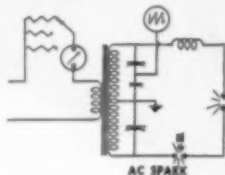
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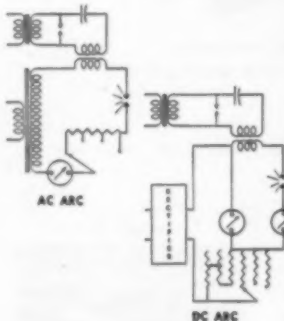
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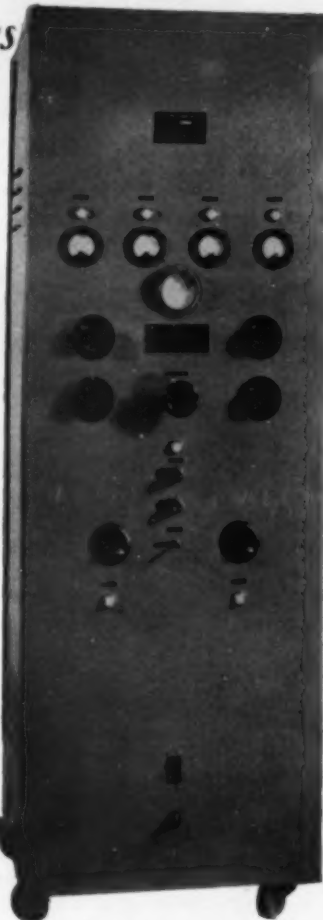


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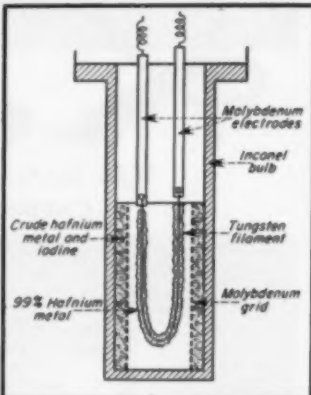
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News, cont. . .

62.5 percent BHC and 37.5 percent DDT, has the advantage that at room temperature it will not solidify for 72 hr.

An absorptive carrier is then spray impregnated with this melt to make a 9 percent gamma BHC-15 percent DDT concentrate. This concentrate is then usually blended with twice its own weight of non-absorbent extender for 3-5-0, or sulphur and extender for 3-5-40.



Hot Filament Method Yields First Commercial Hafnium

This year American industry will use over 400 tons of hafnium—practically all of it as an impurity in zirconium and its compounds.

Soon, however, pure hafnium metal may become available for the first time in substantial (pound) quantities. For Foote Mineral Co., Philadelphia, has developed a technique for separating hafnium from zirconium and of producing 99 percent Hf metal. Production has been under way for the past 19 months. This makes Foote the first commercial producer of hafnium (AEC's Oak Ridge Laboratories announced production three months ago). Foote's development work began in late 1947 under a project sponsored by the U. S. Air Force.

Big problem in producing hafnium is to get it out of the zirconium that's almost invariably associated with it. This calls for real ingenuity since the two elements are almost identical in many physical and chemical properties. Here's how Foote does it:

1. Hafnium oxide is made by fractional distillation of a mixture of phosphorus oxychloride and zirconium tetrachloride (which normally contains about 3 percent hafnium tetrachloride). Hafnium, along with other

low-boiling chlorides, is concentrated in the distillate. Chemical treatment gives a high-purity oxide.

2. The oxide is converted to tetrachloride by direct chlorination at 950 deg. C. in the presence of carbon. Conversion of oxide is about 93 percent.

3. Tetrachloride is mixed with Mg and heated to 650 deg. C. When the reduction is complete, the reaction products are leached with 5 percent hydrochloric acid and washed with water. Product is hafnium metal sponge.

4. This crude metal is heated at 300 deg. C. in an atmosphere of iodine to get the tetraiodide. This is vaporized at 600 deg. C. and contacted with a hot tungsten filament where, at about 1,100 deg. C., it decomposes into hafnium and iodine (see cut). This "hot wire" technique is used because of the high melting point (2,130 deg. C.) of the metal. Optimum ratio of iodine to hafnium charge is 1:50. The deposited metal is 99 percent or more pure.

What's the future of hafnium? No one knows for sure—not even Foote. "But at last," they say, "We have specific data on the metal: its physical, chemical and crystalline properties, its close similarity to zirconium, its corrosion resistance to various chemicals." (Continued)

CONVENTION CALENDAR

American Society of Lubrication Engineers, annual convention and Lubrication Show, Bellevue-Stratford Hotel, Philadelphia, April 16-18.

Association of Consulting Chemists & Chemical Engineers, Shelbourne Hotel, New York, April 24.

Society of Chemical Industry, Perkin Medal Award, New York, April 27.

Catalysis Club of Philadelphia, Third Symposium on Catalysis and Reaction Mechanisms, Engineering Building, Room 314, Philadelphia, April 28.

American Petroleum Institute, Division of Refining, 16th mid-year meeting, Mayo Hotel, Tulsa, Okla., April 30-May 3.

American Oil Chemists' Society, 42nd annual meeting, Hotel Roosevelt, New Orleans, May 1-3.

American Institute of Chemists, annual meeting, General Brock Hotel, Niagara Falls, Ontario, Canada, May 9-11.

Armed Forces Chemical Association, annual meeting, Claridge Hotel, Atlantic City, May 10-12.

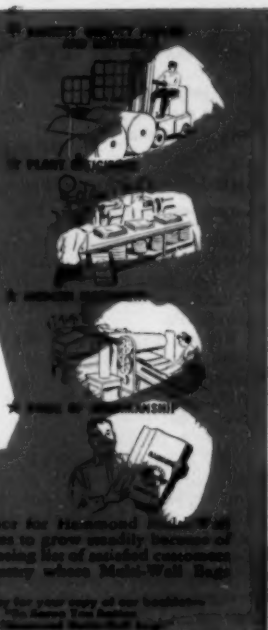
American Institute of Chemical Engineers, regional meeting, Hotel Muehlebach, Kansas City, May 13-16.

Society of Cosmetic Chemists, semi-annual technical meeting, Biltmore Hotel, New York, May 18.

Society of the Plastics Industry, annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., May 24-25.

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Third Unit Reopening at Koppers Butadiene Plant

Office of Rubber Reserve has authorized the chemical division of Koppers Co., Inc., to reactivate the third of four alcohol butadiene units at Kobuta, Pa.

Koppers put one unit of the government-owned plant in operation last November. The second unit began producing in February. The third unit probably will start turning out butadiene for the nation's synthetic rubber program sometime in June.

The butadiene plant is adjacent to the Koppers-owned styrene plant at Kobuta. Styrene for the synthetic rubber program is now being made by Koppers for the government.

When all three butadiene units are running, they will gobble up 6,250,000 gal. of 190-proof alcohol a month, turning out 15 million pounds of butadiene monthly.

New Utah Unit Will Convert Smelter Gas Into Sulphuric

When they start operating this summer, the new facilities of Garfield Chemical & Manufacturing Co. at Garfield, Utah, will produce 500 tons of sulphuric acid daily. The new production unit is jointly controlled by American Smelting & Refining Co. and Kennecott Copper Corp. The project will cost close to \$6,750,000. It will greatly reduce smoke problems at the adjacent smelter.

Acid will be made from sulphur dioxide emitted by converters at the mammoth AS&R copper smelter, with effort being made to recover a maximum of SO₂ from the gases.

Flues over 100 ft. high and 22 ft. in diameter are under construction leading from smelter converters to a new gas cleaning plant. The SO₂ gases pass from the flues to a Cottrell precipitator, where solids are removed. Some lead and copper will thus be obtained.

High voltage and low amperage currents cause the dust in the gases to adhere to corrugated steel plates in the precipitator. These plates are "rapped" with automatic hammers, causing the collected dust to fall to bins. Gases, meanwhile, move off to a pair of lead-lined scrubbers and rise against a constant fall of misty water.

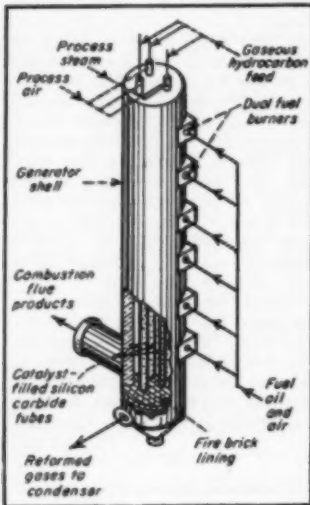
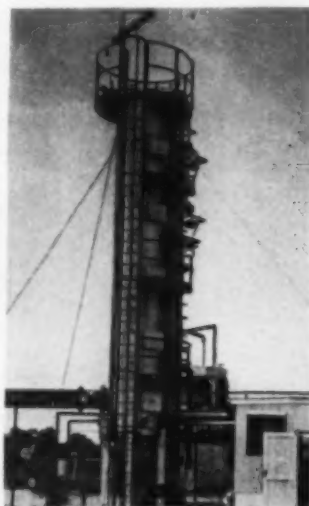
Scrubbed gases move to a mist

Cottrell precipitator where water is removed. Cleansed gases then move to the acid plant via a 5-ft. lead pipe over a third of a mile long.

The 5 percent sulphur dioxide gas is heated and converted to sulphuric acid through a standard contact acid process. The acid is expected to be from 93 to 98 percent pure. Some oleum or 103 percent concentrated

sulphuric acid will also be made.

The new facilities will raise sulphuric production at the smelter from 250 tons to 500 tons daily. Even so, demand in the Intermountain area will continue to exceed supply. Garfield Chemical has already contracted to meet the acid requirements of the \$3.5 million plant of Filtrol Corp. in nearby Salt Lake City.



New Processing Tool: Catalytic Gas Reformer

Chemical industry may soon be using a new tool: the continuous catalytic gas reforming unit of Gas Machinery Co. of Cleveland. The Gasmaco process, developed on a pilot plant scale over the past two years, is now being commercialized.

First unit is going up in Belgium to make synthesis gas for utility purposes. Another will soon go in at a specialty glass manufacturing plant at Three Rivers, Que.

Now several chemical and petrochemical firms in this country are considering the Gasmaco process as a source of synthesis gas for chemical processing. The product can be used for making ammonia or methanol, for hydrogenation processes and for metal and ore reductions. The reforming furnace may well find use in other gaseous chemical processes: it is the only large tubular reactor that can be used up to 2,700 deg. F.

Heart of the process is the generator (see cuts); heart of the generator is its catalyst-filled tubes of silicon carbide; secret of these is their length—

up to 28 ft., or about five times as long as the usual carbide tube. Gasmaco did this trick by working out a way to join short tubes with ball-and-socket joints and a high-temperature sealing salt.

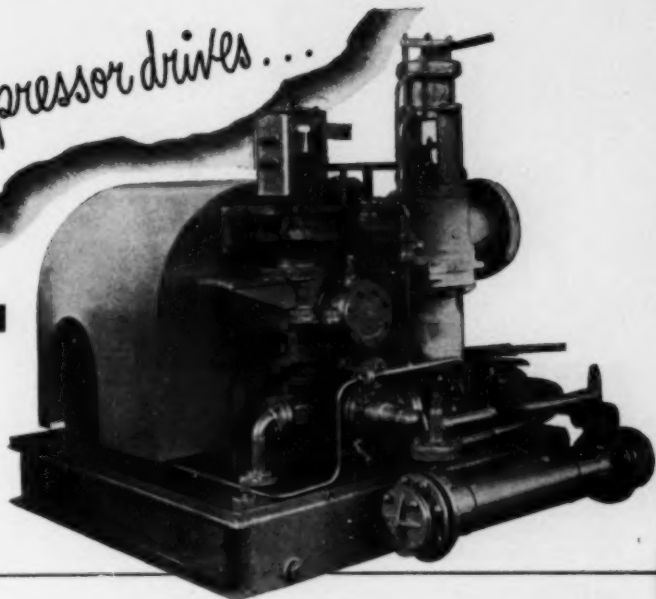
The generator is a steel, brick-lined vertical cylindrical furnace heated with dual burners using gas or oil. The three or more catalyst-filled carbide tubes (3 in. I.D.) run the entire length of the furnace. Capacity can be increased by putting in more tubes and by controlling the feed stock.

Steam, air and gaseous hydrocarbon feed—natural gas, propane, butane or straight-run gasoline—are fed into the top of the tubes. Reformed gases (largely H₂, CO, CH₄, and other saturated paraffins) flow out the bottom, go through a water-cooled condenser. Properties of the product gases can be modified by: (1) zonal temperature control in the tubes; (2) ratio of hydrocarbon constituents in the feed stock; (3) gaseous pressure in the tubes; (4) type of catalyst; (5)

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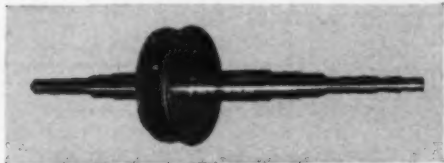
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The importance of modern pH equipment is widely recognized in many fields... from food processing to sewage treatment—mining and smelting to electroplating—textile manufacturing to sugar refining. But when considering pH equipment for your problems always remember this...

"No pH meter is better than electrodes designed for use with it!"

Only Beckman provides such a wide variety of versatile, accurate and dependable electrodes—a type to meet virtually every industrial, research, laboratory and medical requirement. This is your assurance that, in Beckman pH equipment, you have maximum adaptability to widely-varying pH applications.

FREE... a convenient 28-page catalog illustrating the complete line of Beckman electrodes and pH equipment is available from your authorized Beckman Instrument dealer. Or write direct!

Whichever your pH electrode requirements, contact Beckman.

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Factory Service Branches: Chicago—New York—Los Angeles

Beckman instruments include: pH Meters and Electrodes—Spectrophotometers—Radioactivity Meters—Special Instruments

Typical Advantages of Beckman Electrodes



Virtually Unbreakable

Where abrasive slurries or rough industrial service are problems, Beckman has the answer with electrodes so strong, so tough, so chemically-resistant to alkalis and acids they set entirely new standards of durability!



Extreme Temperatures

Want to make measurements in solutions as cold as 20°C. below zero... or as hot as 130°C. above? Hot, cold or in-between, there's a Beckman pH Electrode to do the job!



Wide pH Range

Electrodes covering the full pH range permit accurate measurements even at extreme limits with negligible sodium ion error whether test solution is hot or cold!



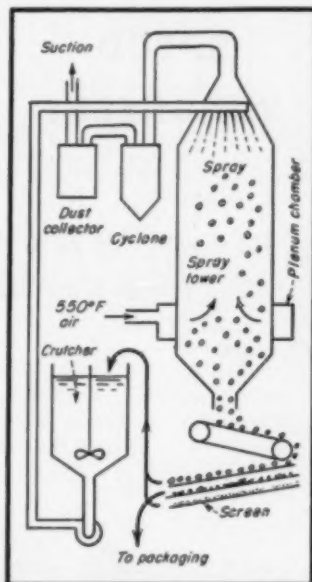
Unique Construction

Beckman glass electrodes are factory-sealed, require no maintenance, feature patented internal shielding, heat-resistant construction, integral leads and many other advantages!

News, cont. . .

amounts of steam and air admitted with the feed. Upper temperature is limited largely by the catalyst carrier rather than by the carbide tubes.

One of the advantages of the Gas-maco generator is its low investment cost; the only feasible substitute for silicon carbide is alloy steel, which costs three to four times as much and has a shorter life. Operating costs are also low: a semi-automatic unit making 500,000 cu. ft. per hr. of make gas needs only two operators. A wide range of raw materials can be used in feed stocks since the unit permits extremely flexible operating temperatures.



Hot Spraying Detergent Solves Packaging Problem

Buying psychology of housewives and standardized packaging machinery were the two causes of a problem that Armour & Co. had to solve before it could market its new sudsless detergent.

Housewives with an eye for a bargain almost always select the larger package, though net weights are identical. And it takes a pretty large volume to fill the 19-oz. package that standardized detergent packaging machinery handles. But Armour's detergent was a rather dense material. What was called for was a decrease in apparent density; that is, an increase in volume. That's where the Armour hot spray process came in.

The formulation, consisting of a non-ionic detergent, a soil-suspending agent, a builder and a fluorescent brightener, is mixed in a standard crutcher. It is then pumped at high pressure to an atomizer head at the top of the spray tower. The droplets fall through the tower, encounter an upward blast of 550 deg. F. air and expand into hollow shell forms of much lighter apparent density.

Small particles that may be carried out of the top of the tower by applied suction are recovered in cyclone and dust collectors, then returned to the crutcher in periodic cleanings. Particles that fall through the tower discharge onto a conveyor belt and are carried to a screen. Proper size particles are passed on to packaging operations. Coarse and fine particles are returned to the crutcher for reworking.



Phosphoric Concentrator Uses Submerged Combustion

First submerged combustion concentrator to be used on phosphoric acid is now operating successfully at the Wendell, Idaho, plant of Gates Bros., Inc. The concentrator was designed by Chemical Construction Corp., New York, and built in the Gates shops at Wendell.

Wet process phosphoric acid of 26-28 percent P_2O_5 is filtered to remove gypsum, then concentrated continuously to 50-54 percent P_2O_5 in the concentrator (see cut). Some 2,000 cu. ft. per min. of heated air passes through the special alloy dip pipe in the concentrator. Fuel oil is used for heating the air; fuel efficiency is 90 percent. The lead-lined steel shell is covered with special acid brick.

Daily capacity of the concentrator
(Continued)

THIS IS TRI-CLOVER

**WHERE YOUR CORROSION RESISTANT
PIPING PROBLEMS
ALWAYS FIND THE RIGHT ANSWER**

TRI-CLOVER offers over 30 years of specialized experience in solving corrosion-resistant piping problems for Industry. Skilled craftsmen and engineers in four completely equipped plants have made the name *Tri-Clover* on stainless steel and alloy fittings, valves, pumps, and specialties signify unexcelled performance.

Your selection of the *right* fitting, tubing or pipe for the *right* job is made easier by Tri-Clover's complete production and engineering facilities. Benefit from this fact. For here is one dependable source . . . one responsibility for your piping problem.

Remember to specify Tri-Clover!

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TRI-CLOVER AND STAINLESS STEEL
SANITARY FITTINGS, VALVES,
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FABRICATED STAINLESS STEEL
INDUSTRIAL FITTINGS AND
INDUSTRIAL PUMPS

THE Complete Line

IN RECENT TESTS THIS CHAIN OUTLASTED MALLEABLE IRON CHAIN BY 20 TO 1!



Send us your problem. If, after investigation, our engineers cannot guarantee that Beaumont Beucalloy Elevator Chain,* above, will save you money, we will not recommend its use.

*A new Bulletin, 70-B, is available upon request.



Beaumont

BIRCH COMPANY

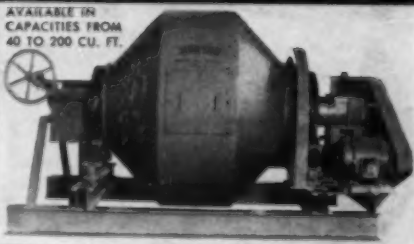
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DESIGNERS—MANUFACTURERS—ERECTORS BULK MATERIAL HANDLING SYSTEMS

The **MUNSON** Rotary BATCH MIXER

**UNEQUALLED for Mixing
Dry Ingredients**

AVAILABLE IN
CAPACITIES FROM
40 TO 200 CU. FT.



• The Munson Rotary Batch Mixer is unequalled for mixing or blending dry ingredients. It's the work-horse in many modern chemical plants where thorough blending and mixing, plus economy of operation and maintenance, are requirements of major importance.

• Design of this Mixer is flexible, to meet varied requirements. Built for either overhead, working floor or basement installation, Munson Rotary Batch Mixers, range in capacity from 40 to 200 cu. ft. Total capacity depends upon desired size of batch and weight per cu. ft. of ingredients.

• In addition to general chemical applications, these Mixers are widely used in mixing fertilizers, gelatins, glue, disintegrated metals, paint ingredients, plastic compounds, soap and cleaning compounds, and a wide variety of stock feeds and tonics.

• A Munson representative will assist you in selecting the proper Mixer for your requirements. Write for full information to "Dept. M".

Munson Mill Machinery Co.
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MUNSON, N.Y.

MACHINERY BUILDERS SINCE 1825

Also available from Munson: Rotary Knife
Cutters . . . Hammer Mills (25 to 100 hp)
... Attrition Mills (18", 24", 30", 36")

7-WAY ACTION
ACCURATE BLENDING
SPEEDY MIXING
RAPID INTAKE
RAPID DISCHARGE
LOW HORSEPOWER
LOW OPERATING COST

News, cont. . .

is 60 tons of 50 percent P_2O_5 acid. Exit gases pass through a Pease-Anthony scrubber system. All P_2O_5 losses are less than 0.5 percent.

The Gates plant, newest triple superphosphate unit in the United States, uses an improved process to make a premium-grade fertilizer. The process (see next month's Chemical Engineering for more details) was developed by Gates engineers under the direction of General Manager George F. Wilkins.

Mathieson Will Construct Caustic Plant Near Mobile

Mathieson Alabama Chemical Corp., a new wholly-owned subsidiary of Mathieson Chemical Corp., will build a chlorine and caustic soda plant near Mobile, Ala. A 500 to 1,000-acre site has been selected at McIntosh, about 40 mi. north of Mobile.

Salt from the McIntosh Salt Dome will supply brine for the manufacture of chlorine and caustic soda.

The new plant—Mathieson's first in the area—will use the Mathieson stationary mercury cell process for the electrolytic production of chlorine and caustic. The unit is expected to be in operation by early 1952.

Output of the new plant is expected to be consumed in the Gulf Coast area. Defense demands for both chemicals have increased substantially along the Gulf.

Chemical Plants Division of Blaw-Knox Construction Co. will build the new corporation's plant. Electricity will be supplied by the Alabama Power Co. In full operation, the new plant will require 100 employees.

Cold rubber production at its Pasadena, Tex., plant will be increased 25 percent by Goodyear Synthetic Rubber Corp. by addition of new equipment. Goodyear has awarded Tellepsen Construction Co. of Houston the contract for a 124 percent over-all expansion of production. Present rated capacity: 60,000 long tons annually. Demonstrated capacity: 73,000 tons.

New sulphonation unit, twice the size of its old plant, is being constructed in Chicago by Stepan Chemical Co. It's to be ready in June. Company makes alkyl aryl sulphonate detergents, lauryl sulphates and sulphonated vegetable oils. It recently completed a spray dehydration tower for drying special detergents used in the industrial field.

—End

COMPLETE SYNTHETIC RESINS PLANTS



ALKYD

VINYL

COPOLYMER

SPECIAL

PHENOLIC

STYRENE

METHACRYLATE

UREA

SILICONE

VINYLDENE

MELAMINE

*If you plan to manufacture
synthetic resins . . . consult*

CHEMICAL PLANTS
DIVISION
BLAW-KNOX
CONSTRUCTION
COMPANY

P.O. BOX 778
PITTSBURGH 30, PENNA.

MANY OF AMERICA'S BEST SYNTHETIC RESIN PLANTS
WERE DESIGNED AND BUILT BY BLAW-KNOX

Readers' Views & Comments

(Continued from p. 140)

cise method of presenting the data. (3) The articles are authoritative. We in Du Pont know Cecil Chilton as a careful, thorough workman.

Shortcomings: The author has dealt with the principal one, namely the difficulty of choosing a typical figure for any given operation. But scale of operation is only one factor which may affect the range of manhours, electric power, steam, etc. Another is the state of the art, i.e., economies achieved through continuity of operation, size of units, instrumentation or energy recovery.

Possible improvements: (1) I believe what the reader wants is more of the same. The age-old complaint of the handbook user applies here—the particular figure wanted always seems to be missing. (2) Emphasis might be placed on those cases in which the particular factor is critical, e.g., it is much more important to discuss power requirements of electrolytic and electrothermal processes than to cover those in which power is a minor factor. (3) Some readers may find it difficult to interpolate on a log scale. Why not insert the values opposite each item?

Finally, I should like to make a general observation on cost estimation: As long as this highly important function is regarded as incidental to other developmental activities, the results will in general be unsatisfactory.

In twenty cases of abandoned projects, "autopsies" showed that faulty economic analysis was responsible for wasted effort in all but three cases. And, I might add, amateurs were responsible for the faulty analyses.

CHAPLIN TYLER

Development Dept.
E. I. du Pont de Nemours & Co.
Wilmington, Del.

Six months or less from now we hope to have a series of pleasant surprises for Reader Tyler—and most of our other 36,026 subscribers, too.—Ed.

Sir:

Your article on labor requirements . . . will be useful in my thinking, mental indexing and checking. Its chart gave me several surprises. For

example, I would have erroneously expected that hydrogenation of cottonseed oil would require more labor than electric steel. . . .

I feel that these articles should and will logically lead to a second series that will give more completed data. . . . The chemical engineer is indeed hard to please: he wants full information on everything on a ready reference card!

LOYAL CLARKE

Chemical Engineer
Roslyn, Pa.

War—and Editorial Casualties

Sir:

. . . liked your "War and the Chemical Process Industries" report in February. For my money it's the best annual review in several years.

I don't imagine, though, that Columbia University will be very proud of the process (p. 128) that makes acetaldehyde by partial dehydration of alcohol . . . dehydrating ethylene is even more difficult.

What about p. 124 where you list Continental Oil's carbon black plant capacity at 5,000,000 lb.? I hope it's closer to 30,000,000 lb.—which would be in line with the factor given in "Industrial Chemicals" by Faith, Keyes and Clark. It would be unfortunate if you proved our estimate wrong!

W. L. FAITH

Chemical Division
Corn Products Refining Co.
Argo, Ill.

(1) Columbia still has reason to be proud. But not one befuddled editor who's now trying to register for a course there on how to hydrate ethylene and dehydrogenate alcohol. (2) Reputation of the Faith-Keyes-Clark book remains intact: correct carbon black figure is about 25,000,000 lb.—En.

Sir:

On p. 135 in your February issue you said: "The one synthetic amyl producer elected to fill the demand of antibiotic producers and once more to relinquish his place in the solvents

market. Prime result: there was a shortage of higher alcohols. Secondary result: some formulators had to turn to other solvents."

If you were referring to Sharples Chemicals as "the one synthetic amyl producer" . . . you were not correct in inferring that we reduced the volume of our products going into the solvents field.

Our distribution of Pent-Acetate, synthetic amyl acetate, to the solvents field as percentages of our total domestic sales:

1949	.....	21.6%
1948	.....	24
1951 (Est.)	.....	29

. . . our 1950 production was greater than in 1949, is estimated to increase again this year. So both volume and percentage of production to the solvents field are increasing.

. . . We are definitely not withdrawing from the solvents business. We intend to remain in this field . . . and are carrying on an application research program to develop up-to-date information on the use of our products in surface coatings.

The supply of higher alcohols would not be affected by the distribution of our synthetic amyl alcohol mixture as very little has gone into this application in recent years.

C. D. KARLSRUHER

Manager, Public Relations
Sharples Chemicals, Inc.
Philadelphia

We regret our slip, appreciate the factual and clear-cut way Mr. Karlsruher has set us straight.—Ed.

Sir:

. . . I have the impression that there is considerable duplication in your [Feb.] report . . . and that the same conclusions are reached in a number of places. Maybe it's impossible to discuss a subject under one head without bringing in other phases of the same subject under other heads.

There are some apparent errors in your statistics, one of which we at Dow contributed to. We wired Dick Warren—too late—to correct information on the breakdown of caustic soda uses. The Solvay and Diamond strikes threw off our estimates . . . we undershot the extent of the national market by some 200,000 tons.

There is another apparent error, on p. 141, where benzene is quoted at 10 cents a gallon (an understatement, to say the least!—Ed).

Now for the good side. Your February issues have become something of an institution with the chemical process industries . . . looked forward to

with anticipation. Your position as a neutral publisher plus your excellent market research group as embodied by Mr. Warren permits you to do an outstanding service for the chemical industries in collecting facts on their annual progress. . . . This year's edition seems to be more comprehensive than ever, very carefully worked out and excellent in editorial content. I can make no suggestions for improvement. . . .

PARKER FRISSELLE
Manager, Market Research
Dow Chemical Co.
Midland, Mich.

That benzene price was about 30% right—on the low side. We do appreciate Mr. Frisselle's comments and corrections—most of all, though, the excellent cooperation he and his associates at Dow have always given us. Without such cooperation from industry our February reviews and forecasts would be worthless.—Ed.

Sir:

. . . a note to tell you how much I liked your February report . . . that it followed somewhat the pattern of last year's review and yet made changes I think were desirable.

In particular, I liked the list of plant projects classified by end product and the listing of new and improved processes. It was too bad that, presumably, shortage of time did not allow you to put the latter in alphabetical order.

. . . the entire February issue was one of the best single issues in years.

ROGER WILLIAMS, JR.
President
Roger Williams, Inc.
New York

CE's editors appreciate these comments from a former CE editor—one who contributed much toward the new style and slant we've adopted for our February reports.—Ed.

For Higher Productivity

Sir:

Your December editorial "America's Road to Victory—Let's Increase Production" has led me to believe that a program of plant inspections on a regular schedule is one way large chemical companies could increase their productivity.

A continuous inspection would require, under top management, a separate department or team of (1) a specialist in power engineering, (2) one or more engineers to examine manufacturing operations, (3) an engineer to check for safety and fire protection, (4) a competent person to check the efficiency of the plant lab-

oratory, (5) an auditor to round out the investigation.

An inspection department would provide first-hand un-biased information on the physical condition and capabilities of each plant in the company. Its report could be supplemented by photographs of equipment and procedures. Advantages would be:

1. Standardization of equipment and methods could be promoted.
2. Deviations from accepted procedures and local experiments of any kind could be checked for desirability or discontinued.
3. The department could serve as a training school for engineers.
4. Management of each plant would be evaluated continuously.
5. Faulty training of employees could be detected more quickly.
6. Knowledge would be made available to those best able to use it, as a report on the findings could be circulated through the company.
7. Every individual in a supervisory capacity would profit from a personal report on any deficiencies found in the performance of his job.
8. A worthy individual would be noticed and possibly offered promotion more quickly than otherwise.
9. Morale throughout the company could be raised.

What do you—and your readers—think of this plan for promoting greater industrial efficiency?

VINCENT F. BUBIENIEC
Chemical Engineer
37 Oliver Street
Everett 49, Mass.

It has much merit, deserves careful consideration. How to increase production and productivity is the major challenge to the chemical industries today.—Ed.

One More Break-Even Point

Sir:

In the article by R. D. Newton and myself in February ("Use Break-Even Charts Without Fuss, Muss or Bother") you left out our reference and credit to the work that Roger Williams, Jr., has done in this field. His article "Pricing New Products for Maximum Profit" was published in *Chemical Industries* (p. 624, Oct. 1947). . . .

R. S. ARIES
President
R. S. Aries & Associates
New York

Groans one red-faced editor: "Guess the Fuss & Muss got me. I apologize to Messrs. Aries, Newton, Williams, Chemical Industries, and CE readers. Can we call it a break-even now?"—Ed.

—End

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LINED Steel Pipe

for greatest resistance to corrosive liquids & gases!

Wherever pipe-line corrosion is a problem . . . wherever corrosive chemicals, oils, acids and solvents are carried . . . specify Michigan Saran Rubber lined steel pipe.

Available in either fabricated light gauge steel or standard steel pipe in 10' and 20' standard lengths ranging in size from 8" up . . . or fabricated to your exact requirements.

For additional information on Michigan Saran Rubber lined steel pipe and fabricated or standard cast iron flanged fittings . . . write today to your nearest "mpc" representative or to our Applications Engineering Dept.

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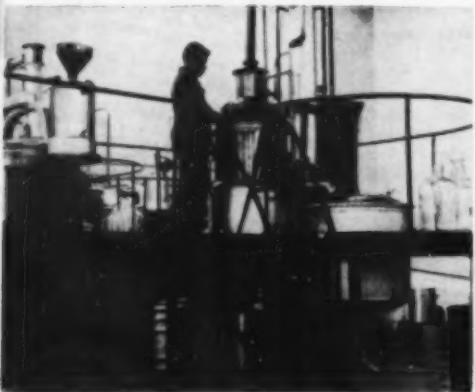
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MICHIGAN PIPE COMPANY



Research Director Rosenkranz: in jungle root, a steroid nucleus.



Oxygenization Process: heat, pressure knock off side chain.



Another Intermediate Process: more pressure.

Revolution in Synthetic Hormones

New process plus yam-like jungle plant yield 75 percent of world output from one Mexican firm.

Volume and down-to-earth prices distinguish current U.S. imports of steroid hormones from Mexico. Responsible for these unprecedented conditions: Syntex S.A. whose plant and laboratory are located at Cuernavaca, about 60 mi. south of Mexico City. They're shipping out a ton a month of the steroids—75 percent to the U.S. where they are being tried out, often successfully, against arthritis and other degenerative diseases. Right now, production could go to 10 tons a month if the demand were to take a sudden upswing. And it won't be long before the firm will be prepared to turn out endless quantities.

Prices run about like this: testosterone, the male hormone, \$3 per g. (down from \$70 per gm. a few years ago); estrone, the female hormone, \$7 per g. (was \$220); progesterone, \$8 (was \$150).

The Syntex people have pulled off a Cinderella's pumpkin sort of magic. They've learned to turn a common tropical plant known as niggerhead into a soapy-feeling compound called sapogenin. Sapogenin molecules contain the basic steroid nucleus which can be separated and built up chemically into a range of hormone compounds. Research and production director George Rosenkranz turned the trick by applying some of the synthetic procedures he learned while studying in Switzerland under Leopold Rosicka who won a Nobel Prize for his work on hormones. Rosenkranz has used large-scale, modern facilities to transform research results to tonnage products—a prime factor behind the dramatic drop in prices.

Emeric Solmo, Hungarian-born head of Syntex, is readying domestic plantations to grow the raw material. Meanwhile, his men search it out in the lowland jungle of Mexico.

More uses for the hormones are constantly sought at the company's research laboratory, one of the four biggest in the field. There is still considerable confusion on these uses. For instance, opinion on the value of Syntex's main product, pregnenolone, to victims of arthritis is conflicting. Some doctors claim to have achieved nearly the same effect as that from more widely-publicized ACTH and cortisone without their bad side effects. Others say they achieved no results whatsoever.

Chemical Specialties Co. of New York (wholly-owned sales organization which has built Syntex's already-healthy volume of sales in the U.S. drug field) took advantage of the controversies by sponsoring a recent symposium on steroids in Cuernavaca. They invited 50 prominent specialists to evaluate and to establish a better understanding of the steroid group—and, incidentally, to explore sales potentialities. Clinical experiments in a variety of human ills from ulcers to high blood pressure were discussed.

(Continued)

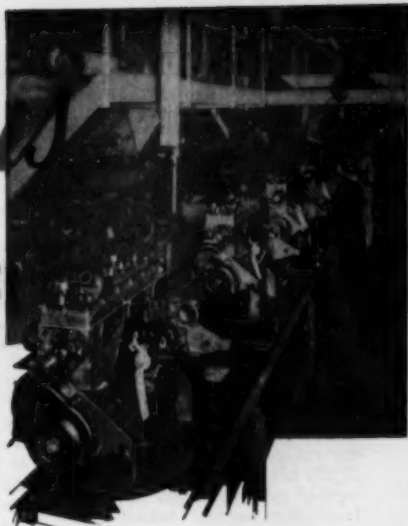
IT MUST BE *Continuous* TO BE PROFITABLE

An Automotive Assembly Line

Chemical processing is like an automotive assembly line in one respect — interruptions cost money. De Laval centrifugal machines make many processes continuous that once cost valuable minutes or even hours with inferior settling or filtering methods.

Centrifugal machines for chemical processes have three basic applications: (1) continuous separation of two liquids, (2) continuous clarification of one or two liquids, and (3) continuous separation of two liquids plus the continuous removal of solids from one or both.

For each of these forms of centrifugal separation there are specially designed machines. Sometimes a disc type Separator is called for, sometimes a Multiple Clarifier, sometimes a "Nozzle-Matic" having a capac-



ity (based on the gravity, viscosity and other attributes of the product) of from 600 to 6,000 gallons per hour.

Consult a De Laval engineer — you may find that De Laval has already tested some material very similar to yours.

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So Should
CHEMICAL PROCESSING
be Continuous
and DE LAVAL
CENTRIFUGAL MACHINES
Make It So!



De Laval

the First Name in Centrifugals
the First Thought for CONTINUOUS
SEPARATION • CLARIFICATION • CONCENTRATION

The upshot: medicine has definitely found an important new tool but much of the research still lies ahead. Syntex is making free gifts of steroid hormones of all varieties it manufactures to hospitals and clinics doing experimental work.

Reported This Month . . .

CANADA

Platforming unit, Canada's first, will be installed at Canadian Oil Co.'s \$18 million refinery under construction at Froomfield, Ont. The unit will have a 3,800 bbl.-a-day capacity; refinery's throughput will be 20,000 bbl. In addition to producing high quality gasolines (upgraded from low octane natural and straight run gasolines), the unit will make available to the Polymer Corp. plant at Sarnia, Ont., derivatives needed in making synthetic rubber.

Sulphur will be extracted from pyrites by a process never before used commercially in a \$4 million plant planned by Noranda Mines, Ltd. Probable site is Hamilton, Ont. The pyrites will be heated to a point at which one of the two sulphur atoms attached to each atom of iron is driven off to be recaptured as pure sulphur; the remaining sulphur dioxide will be converted to sulphuric acid by conventional methods. Daily production of 50 tons of sulphur and 100 tons of sulphuric acid is expected. The process will also yield about 100 tons of sinter iron.

Behind the decision to go ahead with the project: (1) the acute sulphur shortage and subsequent rising prices; (2) declining percentages of copper, gold and silver in ores obtained from the firm's properties and the desire to make profitable the substantial pyrites deposits that lie beneath those sections already worked.

Carbon dioxide gas plant is being erected in Winnipeg by Liquid Carbonic Canadian Corp. Scheduled for completion this May, the unit will use oil from Alberta to replace American coke.

A major petrochemical development in Montreal East may get into construction within a few months as a result of joint studies of British American Oil Co. and Shaw-

inigan Chemicals Ltd. The two are on the verge of forming a jointly-owned petrochemical company which would put to use a newly-developed process said to promise substantial economies in the production of basic chemicals now in great demand.

BRAZIL

Paper mill using sugar cane bagasse as raw material is being set up at Piracicaba in Sao Paulo. It will have a yearly output of 10,000 tons of cellulose, beginning about mid-1952.

Daily sulphuric acid output of 50 tons is expected from a plant to be built in Sao Paulo by Cia. Quimica Industrial, CIL. Sulphur will be imported from the U.S. although there are plans afoot for production of sulphur locally from coal pyrites.

A completely integrated 45,000-bbl.-a-day oil refinery has been designed for the National Petroleum Council of Brazil by Hydrocarbon Research, Inc. Plant site is in Cubatao. Ten furnaces have been ordered from Petro-Chem Development Co., New York, for the following services: crude oil distillation, reforming, viscosity breaking, light gas-oil cracking, heavy gas-oil cracking.

Sharp increase in cellulose manufacture coupled with establishment of a steep protective tariff is reported under study by trade and development officials. At present Brazil produces only about 26,000 m. tons while importing 100,000 m. tons last year.

AUSTRALIA

Chloromycetin synthesis by the Parke, Davis process has been started up in a Melbourne plant by Monsanto Chemicals (Australia) Ltd. Production goal is to meet all domestic requirements. Chloromycetin is the second antibiotic to go into production in Australia; Commonwealth Serum Laboratories, operated in Melbourne by the federal government, has been making penicillin for some time.

Top priority in defense planning has gone to chemicals. The government has reimposed controls over corporate capital issues and over individual bank loans. Listed high among those industries requiring capital for additional production

capacity: heavy and agricultural chemicals, plastics, solvents, petroleum products, coal and petroleum chemicals, carbide, graphite and other electrical carbon products, wood pulp, paper (other than newsprint) and paper board.

Gasoline-from-shale plant at Glen Davis has been shut down. Opened by the government in 1940 in the hope that it would ultimately yield 30 million Imperial gallons a year, it never produced more than 3 million—about two days Australian consumption. Selling price of its gasoline: 59c. per gal.

The refining plant, the only one of its kind in Australia, will probably be used to treat imported crude oil at Glen Davis or at a sea-board site. A government aluminum plant nearing completion in Tasmania had been planning to use petroleum coke from the Glen Davis electrodes.

AUSTRIA

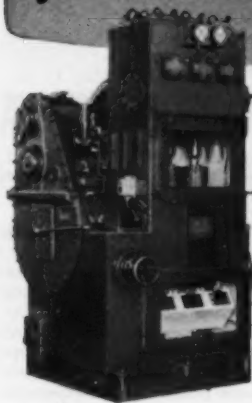
Oil experts with access to information on the Soviet-administered Austrian oil region report that production in wells in Lower Austria was the highest on record in 1950—1.5 million tons. Yield of petroleum products, however, is very unsatisfactory because of out-of-date equipment in the region's seven refineries (aggregate capacity: 1.2 million tons a year). Approximately 50 percent of the throughput becomes heating oil creating a surplus while there is a shortage of gasoline. Only two refineries have small cracking installations.

Russia would not object to Austria selling heating oil surpluses to the West—mainly to Switzerland and West Germany. But as the Russians wish to receive 100 percent of the foreign exchange proceeds, the Austrians are not inclined to such contracts. If Austria were in a position to process the surpluses according to the highest technical standards, she would probably become independent of imports of gasoline and motor oil.

Paper production is to be raised to 370,000 tons annually by 1952 as compared to 240,000 tons in 1950 which in turn was 6 percent higher than 1949. The export proportion, now 50 percent, will go to 70 percent bringing in an additional \$60 million.

Toward this goal, ECA has allocated a total of \$3.4 million to help
(Continued)

There's an **ALDRICH** Pump to meet
your chemical pumping need...



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Aldrich-Groff "POWER-SAVR"
Controllable Capacity Pump.

APPLICATIONS

Among many liquids handled by Aldrich Pumps are: caustic solutions, fatty acids, nitric acid, acetic acid, aqueous ammonia, anhydrous ammonia, as well as liquids encountered in the petroleum refining, petroleum chemical, and other industries.



For automatically controlled delivery

This calls for an Aldrich-Groff "POWER-SAVR"—a variable stroke triplex pump which controls delivery from 0 to 100% capacity at constant pump and motor speed. Control can be accomplished from any remote point, manually or automatically. Power consumption is almost directly proportional to demand. Units handle any free-flowing liquid at discharge pressures from 300 to 15,000 psi and are available in six sizes: from 2" to 6" stroke and from 5 to 125 bhp. Request Data Sheet 63.

For high pressure at small volume

Specify the Aldrich-Lytile Hydro-Pneumatic Unit. This pump is self-contained, uses normal plant air supply as the power medium, and provides high pressures (up to 20,000 psi) at small volume. Request Data Sheet 69A.

For medium to high pressure service

Here, several types of constant stroke pumps are available—depending upon the service involved. You may need the Inverted Vertical Triplex (Data Sheet 66), the Vertical Triplex (Data Sheet 26), or the Direct Flow Triplex or Multiplex Pump (Data Sheets 64, 64B).

From our experience in building pumps for the chemical industry, we can—from our engineering and service files—frequently make specific recommendations to meet your chemical pumping needs . . . whether your problem involves corrosion, high viscosity or high pressure.

Any or all of the above Data Sheets are available on request.

Aldrich Accumulators are also available to meet your displacement requirements. For information on hydro-pneumatic and weight-loaded types, request Data Sheets 29, 29A.



THE ALDRICH PUMP COMPANY

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finance a \$4.7 million modernization of pulp and paper mill at Gratwein and a new kraft mill at Nettingsdorf which will turn out packaging materials. During the past few months Austria's two top experts on wood chemistry, Anton Wacek and Karl Kratzl, have been on an ECA-sponsored tour of the U.S. studying lignin waste utilization. According to Kratzl, 35 percent of timber raw material used today goes down the Blue Danube. Even now, however, wood using industries are the country's biggest business, contribute most to export trade.

GREAT BRITAIN

Production of sulphuric acid from mineral anhydrite and the possible construction of an \$11.5 million plant for the purpose was discussed at a recent meeting in Britain between a handful of the largest sulphuric consumers and representatives of Imperial Chemical Industries. This mineral exists in several parts of Britain, including Billingham-on-Tees where ICI mines almost 930,000 tons of it yearly. However, sulphuric production from anhydrite is estimated to be about twice as costly as the normal method.

It was proposed that the capital required for the erection and operation of the necessary plant should be jointly subscribed by these interested consumers and that ICI should provide the technical knowledge for its construction and operation. ICI would not contribute any part of the capital expenditure. Another meeting is shortly to be arranged between the parties concerned. It is unlikely that any firm decision will be reached for some time.

Zirconium metal production on a commercial scale has been initiated by Murex Ltd., Rainham, Essex. Sheets down to 0.005 in. in thickness, 6 to 7 in. in width and 2 to 3 ft. in length are being made; within a few months it is expected that sheets up to 12 to 15 in. in width will be available. Rods down to 2 mm. diameter can be supplied and drawn zirconium wire may also be shortly available.

New insecticide material, piperonyl butoxide, is now being produced by Cooper McDougall and Robertson, Ltd. under license of U. S. Industrial Chemicals, New York.

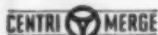
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Even though you believe you have adequate protection in your plant, it will be well worth your time to investigate the many advantages in the collection and disposal of dust and fumes offered by Centri-Merge completely automatic equipment.



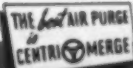
units collect dust and fumes as soon as they occur, clean and scrub them from the air on a swirling tornado of water, permanently trap them under water for quick and easy disposal as sludge.



dust and fume control equipment is engineered and design adapted to your specific requirements. It gives non-fluctuating cleaning efficiency every minute of the day, never requires a shutdown during working hours for cleaning or routine maintenance, eliminates health or fire hazard from dust and fumes, safeguards employee efficiency.



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Alcoa Heat Exchanger News



Published by Aluminum Company of America

Rearmament needs severely limit the manufacture of aluminum heat exchanger tubes. But we realize that the purchase of refinery and processing equipment requires long study of economic and performance factors. That is the reason for this message.

ALUMINUM SAVES $\frac{1}{3}$ in tube costs for Sid Richardson Plant

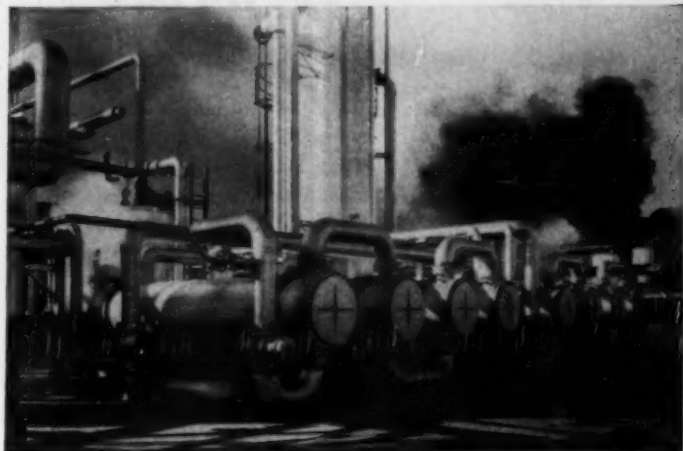
When the Sid Richardson Gasoline Company of Fort Worth, Texas, built their Kermit, Texas, gasoline plant, the Chief Engineer specified Alcoa Aluminum heat exchanger tubes in the eight lean oil—rich oil exchangers. The saving of $\frac{1}{3}$ in tube costs over other metals, together with satisfactory experience dating back to 1927 prompted this decision. Service records have proved that Alcoa Aluminum heat exchanger tubes are not attacked by the sulfur compounds present in this process operation.

STEEL TUBE SHEETS USED

Because possibilities of galvanic action in an oil-to-oil exchanger were slight, the aluminum tubes were rolled in steel tube sheets. The greater ductility and light weight of aluminum tubes made further savings over steel tubes for this same service.

SERVICE LIFE

There are now more than 100,000 pounds of aluminum tubes in-



stalled in this service, all operating at temperatures of 475°F. and over. The aluminum tubes show no sign of corrosion. Experience in similar installations indicates that the aluminum tubes will last indefinitely in such installations.

ALCOA OFFERS BOOKLET



This 24-page booklet will answer many of your questions about Alcoa tubes. It covers fabrication techniques, alloy selection, chemical and petroleum applications. It describes tube cleaning, inhibitors, cathodic protection. It contains complete information on fluid flow and heat transfer. There are formulas, tables and specification data. Write for your free copy today. ALUMINUM COMPANY OF AMERICA, 1860D Gulf Bldg., Pittsburgh 19, Penna.

THESE APPLICATIONS ARE NATURAL FOR ALUMINUM TUBES:

Petroleum

Condensers handling hydrocarbon fractions such as gasoline, naphtha, gas, oil, etc.

Vapor recovery condensers

Lube oil coolers

Natural gas compressor after-coolers

TCC overhead condensers

Recompressor aftercoolers

Hydrogen sulfide gas coolers

Furfural condensers and heat exchangers

Propane chilling

Wax sweaters

Lean oil—rich oil exchangers

Amine solution coolers

Glycol-amine solution coolers and heat exchangers.

Chemical

Butanol

Ethanol

Ethylene Glycol

Glycerin

Hydroabietyl

Isopropanol

Methanol

Phenol

Propylene Glycol

Acetaldehyde

Formaldehyde

Furfural

Heptaldehyde

Acetic acid

Butyric acid

Stearic, Palmitic, Maleic Oleic acids

Naphtha

Ricinoleic acid

Acetanilide

Ammonia

Hydrogen Cyanide

Nitric acid (concentrated)

Pyridine

Hydrogen Sulfide

Benzene

Dichlorobenzene

Gasoline

Gelatin

Hydrogen Peroxide

Turpentine

Xylene

PUERTO RICO

Four major industrial plants will soon be established to supply the island with oil, jute bags, iron and industrial alcohol in case of another world war.

The refinery, to be operated by a U.S. oil company, will produce enough for exports to neighboring Caribbean islands. Raw material will be imported from Venezuela and Colombia.

Henequen, maguey and plantain leaves, native to Puerto Rico, will be used in the \$1 million jute bag plant. The island's sugar industry now has to import bags from India and other far-eastern countries.

Capital is now available for the \$2 million industrial alcohol plant. Also, necessary installations are about to be made at Juncos, source of iron ores in large quantities. Iron will be exported to the other Caribbean islands and South America.

PAKISTAN

Construction of a fertilizer plant in the Mari Indus district in Mianwali is being mullied over by the government. No final decision has yet been taken on production capacity of the proposed plant but the two figures under consideration are 50,000 and 80,000 tons. In the initial stages of production it is expected that a proportion of the output could go to the Middle East.

NETHERLANDS

Growing demand for staple fiber has prompted AKU to begin construction on a rayon plant to open late this year. The firm, whose business increased by \$6.8 million in 1950, will also revive production of straw cellulose, at present a raw material for the paper industry. AKU also hopes to make it suitable as raw material for rayon.

Wool-like synthetic fiber has been developed by the dairy industry in Leeuwarden. Said to be indistinguishable from wool when the two are woven in 1-3 or half-and-half mixtures, it costs about a third of the current wool price.

Red lead plant owned by a joint Dutch-British enterprise has been put into operation in North Brabant. First year's production, 3,000 tons, is for home use but output will be gradually increased for export purposes. —End

Cuts Costs on *Moisture Control!*

Kamp Dynamic Dryers dry Air, CO₂, Ammonia, Gasoline, Nitrogen, Propane to low dew points for as little as 1/4¢ per mcf.

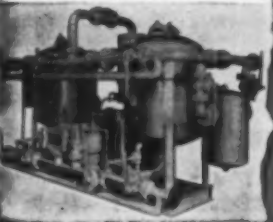
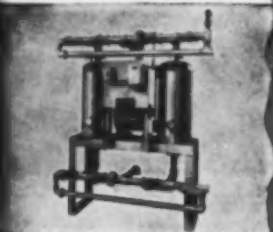
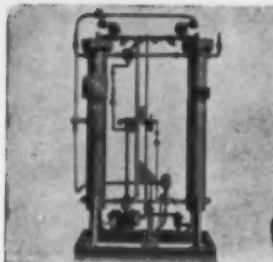
If you think drying air, gases or liquids costs too much—find out how Kemp can save you money! Hundreds of Kemp Dynamic Dryers control moisture at low cost in plants all over the country. Operation is guaranteed to your specifications and the cost is surprisingly low. Many Kemp users report drying to sub-zero dew points for as little as 1/4¢ per mcf—including all charges for labor, capital investment and materials!

Flexible Design

Kemp Dynamic Dryers are versatile—offer manual, semi-automatic or automatic operation. Desiccant is especially selected and compounded for the type drying your problem calls for. With Kemp you can dry air, gases, or liquids, control humidity in large or small areas, or eliminate moisture in materials. Gas, electric or steam regeneration is supplied as standard equipment.

Send for Information

Whether your moisture control problem is standard or special, you'll find Kemp has a Dynamic Dryer especially designed to solve it. Find out how Kemp engineering can be put to work for you to solve your problem . . . save you money. Write today and tell us your requirements. There's no obligation.



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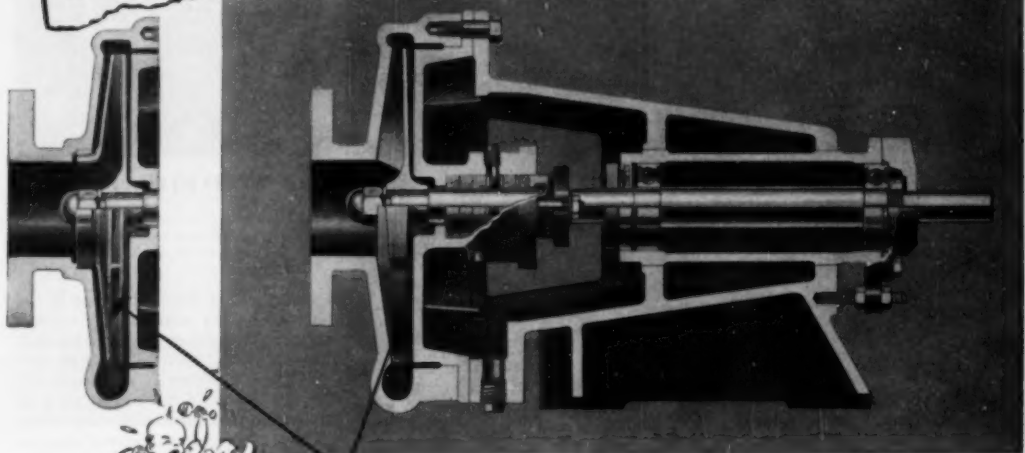
DYNAMIC DRYERS

WRITE FOR Bulletin D-27 for technical information,
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CAMERON: A HISTORY OF THE UNITED STATES

204

Facts you should know about De Laval "CP" process pumps!

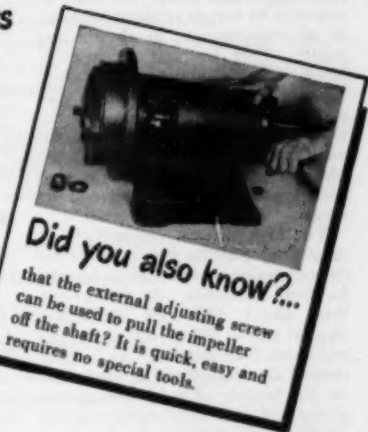


**When service requirements
change, you don't have to
buy a whole new pump!**

The De Laval CP pump can be quickly converted from closed to open impeller (or vice versa) by changing the pump volute and impeller only. This standardization also means you can keep your stock of spare parts to a minimum. Three sizes of shafts, shaft lock-nuts, bearings, bearing cartridges and pedestals fit all nine sizes of De Laval CP pumps.

**Shims and fussy fits are
old fashioned...**

When you have to compensate for wear between the impeller and case, it is only necessary to face off these parts, reassemble the pump and position the impeller with the external adjusting screw provided for that purpose. No shims required—no fussy fits.

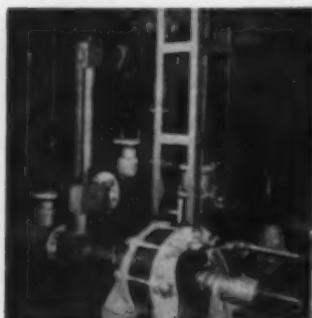


Did you also know?...
that the external adjusting screw
can be used to pull the impeller
off the shaft? It is quick, easy and
requires no special tools.

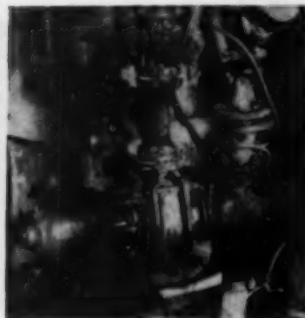
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CARBON, . . .



DURIRON, . . .



and WROTHITE, . . .

. . . are among the materials of construction used to fight corrosion by:

Copper Sulphate

Carbon

W. W. PALMQUIST, National Carbon Division, Cleveland, Ohio

Carbon and graphite, together with their impervious forms, are inert to corrosion by copper sulphate solutions at all temperatures to the boiling points. They are most widely used, chiefly in the impervious graphite form, in the highly corrosive acid copper sulphate solutions found in the electrolytic copper refining and the plating industries. In such cases, sulphuric acid is present to an average concentration of 10-20 percent by weight.

The high thermal conductivity of impervious graphite is responsible for its wide application in heat exchangers for these industries. At the present time, about 100 such exchangers (typical size — 200 to 300 sq. ft. per unit) have been installed. An installation of this equipment at one plant for the heating of a 16 percent sulphuric acid—3 percent copper sulphate solution with steam at 227 deg. F. is now close to 10 years of trouble-free service with no evidence of corrosion.

The above photograph of a copper plating installation shows impervious graphite pumps and piping used for circulating the plating solution of 7 percent sulphuric acid—28 percent copper sulphate at 120 deg. F. through impervious graphite tubed heat exchangers and porous carbon filters. The exchangers are used for heating solu-

tion after shutdowns and for cooling during operation. Porous carbon, a carbon with closely-controlled permeability, is also used for air diffusion into the plating tanks, thereby reducing concentration polarization at the electrodes and allowing higher current densities and cathode efficiencies with a dense, desirable plate.

The use of graphite as a solution grounding electrode in the copper sulphate treatment of gasoline is an interesting application of corrosion resistance combined with good electrical conductivity.

High-Silicon Irons

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

Duriron shows excellent corrosion resistance to copper sulphate solutions and is widely used as chemical equipment where this corrosive is encountered. Copper refineries, copper plating installations, copper and brass pickling installations, and others require the use of corrosion resistant alloys and Duriron finds application in each type industry.

Sulphuric acid is normally present along with the copper sulphate and accelerates corrosion on most alloys. Normally this combination behaves similarly to sulphuric acid alone and the alloys selected should be suitably resistant to this acid. Of course, Duriron is noted for its excellent resistance to all concentrations of sul-

phuric acid at temperatures up to the normal boiling point of each concentration. Unlike many of the stainless alloys, Monel, nickel and others, this excellent resistance is not dependent on the valence of the copper ions present. Duriron exhibits the same high degree of corrosion resistance whether the copper is in the cuprous form, the cupric form, or any combination of the two.

A few of the more important installations are as follows:

1. A large chemical company which manufactures copper salts uses Duriron diaphragm valves for handling their copper sulphate solutions throughout the plant. Solutions range up to 50 percent copper sulphate and up to 10 percent sulphuric acid at temperatures approaching 190 deg. F. A Duriron test valve showed no corrosion after 15 months' continuous operation and because of its excellent resistance to erosion as well as corrosion, replaced lead as the standard valve material.

2. Duriron pumps, valves, heat exchangers, pipe, and fittings are finding extensive application on acid copper sulphate plating solutions. In addition to providing a long service life in this corrosive environment, Duriron does not require careful insulation from the stray electric currents common to plating installations. In this respect, it differs from the high alloy stainless steels, such as Durimet 20 and others, which are very susceptible to accelerated corrosion due to stray currents.

3. A series of tests were conducted on waste acid copper sulphate plating

(Continued)

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To the savings made by the reduction in "Karbate" brand impervious graphite pump prices (up to 33%), add the all-important factor of very low annual maintenance cost. Our records show some pumps in service for years, requiring practically no replacement parts.



Specify **"KARBATE"**
BRAND

**Impervious Graphite
Corrosion Resistant**

PUMPS



- Case and Impeller are of "Karbate" impervious graphite—they do not corrode.
- Stainless Steel Shaft, where exposed to corrosive fluids, protected by "Karbate" impervious graphite.
- "Karbate" impervious graphite rotary seals* are regular equipment—included in basic pump price. They are not "extras".
- No stuffing gland to require packing—a single, occasional adjustment of the "Karbate" rotary seal replaces this cost.

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*Now, even at new low pump prices, "Karbate" rotary seals have been improved. Teflon is used to gasket the seal to the shaft and the gasket is adjusted, independently of pressure, on the seal faces.



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- Freedom from product contamination
- Excellent corrosion resistance
- Rugged construction
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solutions prior to the selection of a suitable material for drain pipe. The solutions tested were (a) 25.8 percent copper sulphate and 6.0 percent sulphuric acid, and (b) 3.0 percent copper sulphate and 0.5 percent sulphuric acid. Duriron showed no weight loss after a one-week test period and was by far the most economical alloy. Tests on many other copper sulphate-sulphuric acid combinations showed extremely low corrosion rates for Duriron.

4. High-silicon iron equipment has found successful application in copper refineries for handling electrolyte solutions containing copper sulphate.

5. Duriron pumps are being used in conjunction with electrolytic cells used to plate out copper from pickling solutions. In one installation, small percentages of hydrochloric acid in the pickle acid corroded the many other otherwise suitable alloys and made the high-silicon iron alloys an even more economical selection.

Worthite

W. E. PRATT, *Worthington Pump and Machinery Corp., Harrison, N. J.*

Worthite is extremely resistant to all concentrations of copper sulphate solutions up to the boiling point. Most of the copper sulphate solutions that are handled in industry involve free sulphuric acid, and CuSO_4 acts as a very effective inhibitor of corrosion on all grades of chrome-nickel stainless steels and the high nickel-chrome-moly alloys.

The very large volumes of $\text{CuSO}_4 \cdot \text{H}_2\text{SO}_4$ solutions occur in the electrolytic refining of copper and in the pickling of copper and brass sheets and parts. In a single large copper refinery 10-20,000 gpm. copper sulphate electrolyte may be circulated to feed the cells continuously with fresh copper solution for plating out on the cathode sheets. The majority of all the copper refining plants in the world use Worthite pumps for this duty. The byproduct plants in these refineries also require many slurry pumps for filter pressing and some of these operations also involve copper sulphate handling. Worthite pumps are also widely used for such slurry handling services.

Copper sulphate is manufactured by the action of hot, dilute sulphuric acid on copper or copper oxide, with evaporation and crystallization. Many Worthite pumps and valves are used in such processes for circulating the very hot $\text{H}_2\text{SO}_4\text{-CuSO}_4$ solution.

The pickling of brasses, bronzes and copper is carried out in much the same manner as the pickling of steel. However, ferrous sulphate in steel pickling solutions acts more as an accelerator of corrosion on the stainless alloys, whereas copper in the sulphuric acid pickle acts as an excellent inhibitor on the chrome-nickel stainless alloys. Hence tanks, piping and valves of stainless alloys are common in the equipment used for pickling brass and copper.

However, the centrifugal pumps are usually made of the higher nickel-chrome-moly "stainless" alloys because chemical pumps are readily available in these alloys and are seldom available from stock in the ordinary stainless alloys. Another advantage of the high-alloy pumps is that they are resistant to the sulphuric acid pickle solutions without copper, or the uncontaminated make-up acid which has no opportunity to pick up copper. This explains why hundreds of Worthite pumps and valves are in common use in all the industries which handle copper sulphate-sulphuric acid solutions in large volume. The accompanying photographs illustrate some of the many applications for Worthite pumps and valves in these industries.

Hot copper sulphate-sulphuric acid solutions promote intergranular corrosion of unheat-treated austenitic alloys, so adequate heat-treatment is absolutely necessary and the stabilized stainless alloys should be employed where field welding is required. All Worthite castings and bars (used for shafts and bolts) are heat-treated to put the carbides into solution and thus prevent intergranular attack. Heat-treatment consists of holding the part at 2,050-2,100 deg. F. for a sufficient length of time and then quenching in cold water. Worthite castings are designed to withstand this drastic treatment.

Nickel and Nickel Alloys

W. Z. FRIEND, *International Nickel Co., New York, N. Y.*

Monel has useful resistance to air-free cuprous sulphate solutions of most concentrations at temperatures up to boiling. However it may be rapidly attacked by aerated solutions or those containing appreciable amounts of cupric sulphate. Inconel is resistant to cupric acid solutions at moderate temperatures but not to boiling solutions. Nickel usually is not as resistant to cuprous sulphate solutions as Monel nor as resistant to cupric sulphate solutions as Inconel, so is seldom used with these chemicals.

Monel is commonly used for handling insecticidal spray solutions of copper sulphate. It occasionally is used for pickling baskets in the sulphuric acid pickling of copper and brass parts where hydrogen is generated in the solution by the pickling process. Inconel is used for parts of filters and other equipment in the handling of copper sulphate sludges in metal refining.

Glass Lining

S. W. McCANN, *The Pfaudler Co., Rochester, N. Y.*

Glass lined steel equipment is fully resistant to copper sulphate solutions in all concentrations up to the normal boiling point and above. Individual units have been used for storage, evaporation and crystallization of copper sulphate.

Stainless Steel

GRANT L. SNAIR, JR., *Allegheny Ludlum Steel Corp., Brackenridge, Pa.*

Copper sulphate is not injurious to the stainless steels, and accordingly, solutions of any concentration at any temperature can be safely handled in stainless steel equipment. Stainless steel Type 304 electroplating tanks holding copper sulphate solutions and vats containing copper sulphate employed as a mordant in dyeing are among the commonly used types of equipment.

Considerable amounts of stainless steel are now being used to replace less corrosion resisting materials in agricultural equipment handling copper sulphate solutions used as insecticides. Spray tanks, tubes, valves, and nozzles made of the various stainless steel grades have proved serviceable.

When added to solutions containing sulphuric acid, copper sulphate serves as an excellent inhibitor of corrosive attack on stainless steel. For example, stainless steel equipment is used for pickling copper and brass.

Boiling solutions containing as high as 10 percent sulphuric acid with 10 percent copper sulphate are used to determine the susceptibility of the austenitic stainless steel grades to intergranular attack. Material in the properly annealed condition will remain entirely free of attack when subjected to this test.

"Passivating" solutions of copper sulphate and nitric acid, as for example a solution consisting of 12 percent nitric acid and 4 percent copper sulphate at 140 to 160 deg. F. are some-
(Continued)

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TYPE F

PLUG VALVES

Corrosion Resisting

with TEFLON LINER

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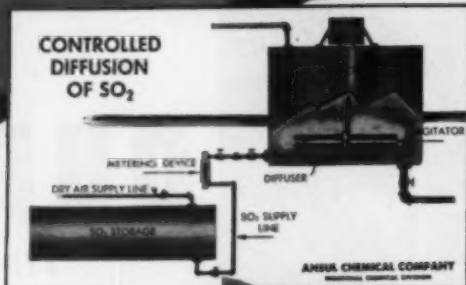
If you haven't already received your copy, let us send you Bulletin 647 with data on materials of construction, corrosion resistance, construction and operating details, sizes and dimensions.

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PRESERVE... DEOXIDIZE... REDUCE...
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Write for Bulletin No. B-109 for more information and if possible, include a description of the application in your plant. Our Technical Staff will help you take full advantage of the benefits outlined above. In addition to our Bulletin describing the Ansul Constant SO_2 Concentration System, we will send you an informative treatise describing the properties, characteristics and industrial uses of Liquid Sulfur Dioxide . . . An Ansul Technical Staff Publication.

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Use ANSUL METHYL CHLORIDE



CORROSION FORUM, cont. . .

times useful for removing iron contamination from Type 410 or 430 surfaces and for imparting a slight temporary improvement in the passive surface condition of the metal. Greatly increased corrosion resistance cannot be expected through the use of such solutions.

Durimet 20

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

Copper sulphate solutions tend to react similarly to dilute sulphuric acid in their corrosiveness to many alloys. However, it is an established fact that copper sulphate in the oxidized state is a very effective inhibitor for the various stainless steels in sulphuric acid solutions.

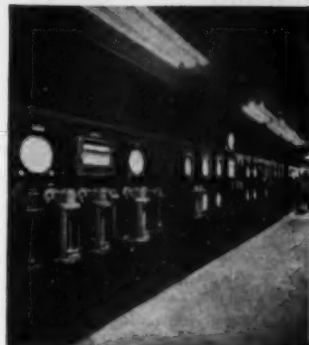
Durimet 20 has good resistance to cuprous sulphate and combinations of cuprous sulphate plus sulphuric acid providing it is not a pickling operation where conditions are highly reducing. Chemical equipment made from Durimet 20 is finding wide application for handling copper sulphate-sulphuric acid mixtures and a few of the typical examples are given below:

1. Numerous Durimet 20 pumps and valves are being used at a large chemical company which handles copper sulphate in their process. The pumps are used to supply the copper sulphate filters and are giving good service after many years' continuous use. Numerous plant corrosion tests on sulphuric acid resisting alloys in copper sulphate-sulphuric acid solutions (ranging from 50 percent copper sulphate and 0.5 percent sulphuric acid to 5 percent copper sulphate and 10 percent sulphuric acid, from 160 deg. to 190 deg. F.) showed Durimet 20 to be surpassed in resistance only by Duriron and even then it gave a very acceptable corrosion rate.

2. Another company uses Durimet 20 "Y" valves for handling a copper pickling solution consisting of sulphuric acid plus copper sulphate in the regeneration cycle for pickle liquor. Very good service is being received. Hooks, guides, and supports made from Durimet 20 and Carpenter 20 (wrought Durimet 20 analysis) are used in the pickling operation in this same installation.

3. The Durimet 20 alloy finds application in handling acid copper sulphate electroplating solutions where a high strength, corrosion-resisting alloy is required. Duriron is, of course, a much better alloy for this service since

(Continued)



The photo above shows the extent to which SK Rotameters are used in the plant of Publicker Industries, Inc. of Phila., world's largest producers of industrial alcohol. All of the Rotameters shown on the panel are of the SK Universal type and are used to measure fluid flow rates in the manufacture of commercial alcohol. Numerous sizes are represented since capacity requirements vary considerably. Bulletin 18-RA pictures and briefly describes the numerous types of Rotameters manufactured by SK and lists the technical bulletins available. If interested, send for a copy.

SK PRODUCTS LIST OFFERED

A new "Index of SK Equipment and Descriptive Bulletins" has just been issued by the company. This index lists products by application and alphabetically together with the numbered descriptive bulletin pertaining to each product. Copies are available on request.



Frito Co. Purges Plant Fumes To Insure That Famous Flavor

Fritos, popular, taste-tempting corn chips of The Frito Company, are made under conditions as ideal as the company can make them to maintain and protect quality and flavor. Even the cooking vapors are collected and eliminated from the cooking tanks and plant. As a simple and efficient method of accomplishing this in various plants across the country, the company uses SK 8" Fume Scrubbers, one of which is shown in the photo, with highly satisfactory results.

Since the cooking vats use oil at about 400° F., large amounts of steam and oil vapors are given off in cooking. These vapors are removed in the following manner:

Water, under pressure, enters the fume scrubber at the top through a

spray nozzle designed to provide an angle of spray most suitable for maximum entrainment and scrubbing efficiency. The velocity of the water spray creates a draft in the chamber of the fume scrubber and causes the vapors to be drawn into the chamber where they are entrained and absorbed by the water which is then discharged into a tank and removed from the plant. In this manner all odorous fumes are entrained by the scrubbing water, and vapors accompanying the fumes are condensed at the same time.

SK Fume Scrubbers, being simple in construction, efficient, and easy to keep clean, are particularly well suited for use in processing plants. For complete details on all types and sizes, request Bulletin 4-R.



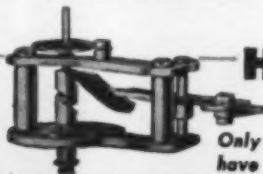
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2. Even if subjected to 30 lb. pressure, no harm will result because the Helicoid cam releases from the roller on the pressure side. Other vacuum gages are damaged by pressure.
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AMERICAN CHAIN & CABLE COMPANY, INC.
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CORROSION FORUM, cont. . .

it offers better corrosion resistance to normal conditions plus superior resistance to stray electric currents. These stray electric currents are capable of rendering the stainless alloys unsuitable since they are capable of destroying the passivity of these alloys.

Chlorimets

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

The inherent resistance of the Chlorimet alloys to most corrosive conditions means that they will provide satisfactory service for most copper sulphate solutions normally encountered. However other less expensive alloys like Duriron and the stainless steels provide at least equivalent resistance for nearly all conditions.

Silicones

J. A. McHARD and J. T. McINTYRE, Dow Corning Corp., Midland, Mich.

Silicone elastomers and resins show good resistance to 50 percent aqueous copper sulphate. The fluids are somewhat less resistant to copper sulphate. Those containing aryl substitution show some loss in viscosity but this is probably due to their greater tendency to form emulsions.

Aluminum

ELLIS D. VERINE, Jr., Aluminum Co. of America, New Kensington, Pa.

Aluminum alloys are not recommended for use in handling aqueous solutions containing copper sulphate.

Coatings

KENNETH TATOR, Kenneth Tator Associates, Coraopolis, Pa.

Copper sulphate, in addition to being an acid salt and therefore requiring the type of protection normally accorded dilute sulphuric acid, is also an oxidizing salt. For this latter reason its corrosive action on steel is much more aggressive than can be accounted for by its hydrolysis to sulphuric acid in aqueous solutions. Corrosion rates up to 1-2 ipy. may be expected under favorable conditions well within the probability of normal industrial occurrence.

Its oxidizing action upon organics is not as pronounced as that of more powerful oxidizing agents such as chlorine water, chromic or nitric acids. So many commonly used organic barriers, which are not outstanding in

their resistance to oxidation, will often give a satisfactory service life. Such materials include the phenolics, furans, and soft natural and synthetic rubbers. Life of these materials will be extended by increasing the thickness of the barrier lining. With thin film coatings, imperceptible discontinuities created during application or subsequent use may result in rapid perforation of the underlying metal or undercutting of the coating.

For longest service life those materials most resistant to oxidizing acids should be used, and these include polyvinyl chloracetates or polyvinylidene chloride suitably compounded for oxidation resistance, polyethylene and its derivatives, polystyrenes, acrylates, and oxidation resistant rubbers such as butyl or hard natural synthetics.

Rubber Lining

J. P. McNAMEE, U. S. Rubber Co., Providence, R. I.

Soft and hard natural rubber and synthetic linings may be used in contact with copper sulphate solutions of all concentrations up to the saturation point within the usual temperature limits for rubber lining materials.

Copper sulphate is usually encountered in plating work where hard natural rubber lined steel is extensively used as a material of construction. It may be used for lining storage and plating tanks and associated pipe, fittings, valves and pumps.

Wood

HENRY B. SMITH, III, Michigan Pipe Co., Bay City, Mich.

Dilute solutions of copper sulphate do not affect wood when operating temperatures do not exceed 180 deg. F. Uncoated wood pipe and tanks have been used satisfactorily for as long as 15 years for handling 5 percent copper sulphate solutions. Manufacturers of chemical sprays are the largest users.

Pitch and tar coated wood pipe and tanks have been used successfully for copper sulphate solutions (pH of 2) in the plating industry. However, operating temperatures are limited to 100 deg. F.

Cements

RAYMOND B. SEYMOUR, The Atlas Mineral Products Co., Mertztown, Pa.

Infusible cements based on filled polymers of furfuryl alcohol, phenol, substituted phenols and polyesters, are completely resistant to all concentrations of copper sulphate within
(Continued)

4

Advantages

SMOOTHER,
ULTRA-FINE GRINDS

SAVINGS
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INVESTMENT COSTS



Typical installation of No. 6 MIKRO-ATOMIZER and MIKRO-COLLECTOR in large conductivity plant

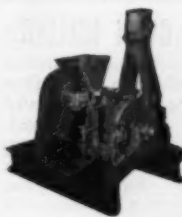
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Because of its phenomenal ability to produce smooth, ultra-fine grinds and blendings at remarkably low temperatures, more and more economy-minded manufacturers are turning to the MIKRO-ATOMIZER as a means of improving their products and lowering production costs.

The MIKRO-ATOMIZER has proved a boon to many manufacturers, particularly in the fine grinding of:



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Pigments	Sugar Mixtures
Insecticides	Food Mixtures
Sugar	Synthetic Resins
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Corrosion proof linings based on natural rubber, neoprene, saran, polyethylene, etc. Write for bulletin 4-1.



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OTHER STARCHES from potatoes and sorghum grains are now processed by Disintegrators, in place of buhrstone mills, rasps or hammer mills.

Write for free technical bulletin on this application.



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441 Fulton St., San Francisco 5, California

CORROSION FORUM, cont. . .

the temperature limitations of the cements themselves. Silicate cement is resistant to copper sulphate solutions but, of course, is apt to spall and disintegrate because of its high water absorption which permits crystallization of copper sulphate within the cement itself. A cement based on melamine resins showed fair resistance to copper sulphate at room temperature but was completely attacked at elevated temperatures. Portland cement and its admixtures were attacked even at room temperature and weak concentrations of copper sulphate.

Plasticized sulphur cements are not attacked by copper sulphate in laboratory tests but are not recommended as jointing materials for brick in copper sulphate tank service because of possible galvanic effects. Cements based on asphalt, hydrocarbon polymers, coal tar and other thermoplastic materials are apparently satisfactory for room temperature service but are not recommended for elevated temperatures.

The best recommendation for corrosion resistant cements in floors or tanks in contact with solutions of copper sulphate at temperatures as high as 350 deg. F. is a carbon-filled cement based on a modified polymer of furfuryl alcohol.

Tantalum

LEONARD R. SCRIBNER, Fansteel Metallurgical Corp., N. Chicago, Ill.

Tantalum is completely inert to copper sulphate, either wet, dry, or in solution. There are other less valuable materials which resist CuSO_4 sufficiently well so that, so far as we know, tantalum has never been used for this application.

Iron and Steel

ALBERT W. SPITZ, Reiter Engineering Co., Philadelphia, Pa.

Cast iron and carbon steel are not recommended for use with copper sulphate solutions.

Lead

KEMPTON H. ROLL, Lead Industries Association, New York, N. Y.

Lead is classified as a "Class A" material when used with copper sulphate according to the "Corrosion Handbook." That is, lead is recommended for use with copper sulphate at all temperatures and with all concentrations. Aqueous solutions of cop-

(Continued)

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Concrete	Plastics
Dishwater	Printing Inks
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Dyes	Soot Liquors
Ether	Starch
Fuel Oils	Swing Liquids
Food Products	Soy Bean Oil
Gasoline	Synaps
Glycerin	Tar
Glass	Tampala Juice
Gum	Turpentine
Glucose	Varnish
Grape Juice	Vegetable Oils
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Lead	

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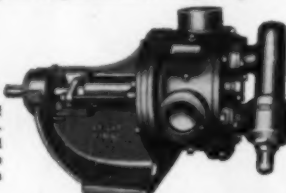


Fig. 134



Learn more of these outstanding facts. Send for your free copy of bulletin S18C today.

Viking PUMP COMPANY
Cedar Falls, Iowa

CORROSION FORUM, cont. . .

per sulphate are acid but in contact with most metallic materials they do not behave as do solutions of equivalent acidity which contain sulphuric acid alone. In effect, copper sulphate in solution is an oxidizing salt and its presence with sulphuric acid accelerates the corrosion of most metals with the notable exception of lead. A protective insoluble film of lead salts form on contact with copper sulphate and act to prevent any further corrosion. Lead is regularly used for anodes and tank linings in the electrorefining, electroplating and electroforming of copper, all of which take place in copper sulphate solutions.

Hastelloy

E. D. WEISERT, Haynes Stellite Co., Kokomo, Ind.

Hastelloy alloys have excellent resistance to pure copper sulphate solutions over a wide range of temperatures and concentrations. These alloys have also given good service in tests made with many of the commercial solutions in which the sulphate is accompanied by sulphuric acid. (Solutions used for leaching, acid copper plating, and brass pickling are examples.) Where both superior structural strength and high corrosion resistance are required, it is generally more economical to use Hastelloy alloys for handling these media. If strength is not a factor, materials with lower alloy content have adequate corrosion resistance.

Some specific examples of the resistance of Hastelloy alloys:

In an air-agitated tank for dissolving scrap copper, containing copper sulphate and 93 percent H_2SO_4 at 180 deg. F., Hastelloy alloy C showed an average corrosion rate of 13.4 mils per year after 14 days exposure.

After 41 days in a brass pickling solution (19 to 28 percent H_2SO_4 and 1.6-4.1 percent $CuSO_4$) at 140 deg. F., Hastelloy alloy C showed an average corrosion rate of 1.6 mils per year; the rate for alloy D on the other hand was 70 mils per year.

Hastelloy alloy C was exposed 32 days in a neutral copper leaching solution (40-70 gpl. $CuSO_4$ and 3-6 gpl. Ag_2SO_4) at 160 deg. F. Despite continuous agitation and good aeration, it showed an average corrosion rate of 52.7 mils per year. After a 32-day exposure in a high acid leaching solution (40-60 gpl. $CuSO_4$, 3-6 percent H_2SO_4 , $MnSO_4$, and $ZnSO_4$) at 140-170 deg. F., with continuous agitation and good aeration, this same alloy showed an average rate of 52.7 mils per year.

—End

PRESSURE-SEAM WELDING TO THE E-PA-T's TASTE

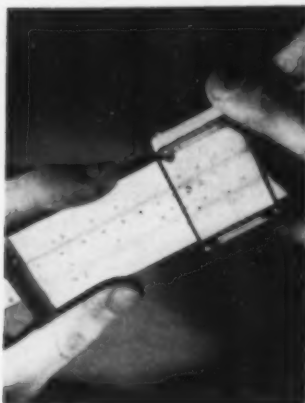
E's for engineer, PA obviously is purchasing agent, and T is for treasurer. So we are saying that Q.C.f. custom-builds pressure vessels (for processing, transportation or storage) on a quality-price basis that satisfies everybody—ourselves included. It's because we have the experience, the equipment, and the flow of work to handle critical-specification welding to the customers' over-all advantage. We'd be glad to "quote from the record," if you're interested. Literature on request.

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PRODUCERS must become . . .



CONVINCENTS to succeed.

You Must "Sell" To Succeed

It was about a century ago that a Mr. R. W. Emerson is said to have made his classic observation that the maker of the better mousetrap could sit at home confident that the world would beat a path to his door.

But that was about a century ago! Today, a highway, not a path, is needed . . . and it must be built by the mousetrap maker himself. In addition the road must be well lighted with neon signs glorifying the qualities of the particular mousetrap and decrying the ravages of the rodent population in general. In a word, "selling" has become a vital part of mousetrap manufacture.

But the realization of the need to sell the merits of his accomplishment, be it idea, product or service, has always been repugnant to the technical man and his fellow creator, the artist. To them the quality of the output creates its own acceptance. And any attempt to influence acceptance by "by promotion" is considered unnecessary and downright unethical.

This thinking has been and probably always will be, the hallmark of the professional man who serves rather than sells. It is especially characteristic of those professionals who do a large amount of creative work such as research scientists, artists, design engineers, and composers.

In the case of those professions that come in more general contact with laymen, however, "selling" as means

of convincing people to act has gradually become standard practice. Physicians, long before the introduction of psychosomatic treatment, realized the importance of a good "bedside manner." And dentists had to turn salesmen, in the name of improved dental hygiene, to convince patients to make recurrent trips to the high-chair faced by a drill.

In industry production engineers had to learn to sell too. On Monday the sale might have to be to a grievance committee; the commodity, reasons for not pulling a strike. On Tuesday, the management might have to be persuaded to increase the plant's production facilities, and on Wednesday, a committee from the local mayor's office might have to be convinced of the impracticality of a proposed tax based on the height of plant fences. But all of it is selling . . . the toughest item of all, ideas.

WHY A NEED FOR "SELLING?"

Today, probably more than at any other time in history, people want to be "sold" on ideas as well as tangible items. They want the product, idea or the man to seek them out and work for their dollar, approval or vote. Most people even welcome and expect competitive sales pitches over which they can sit as judge. And this is true whether the thing being sold is a cigarette, a floor wax or a political creed. "Drummers" have become

merchandising experts. And elected government officials who once smarted under the term "politician" now enjoy being praised by the same word.

Coincident with this general trend to a selling philosophy, another evolution that places a premium on the getting of votes of confidence, was taking place in industry. It was the transition from one-man companies to committee run managements. As a result, individual executives exercised less and less power and inclination to make unilateral decisions. Instead, executive conferences are called, subcommittees appointed and progress reports written and circulated. And the decision that follows is dictated by whether or not a majority of the committee has been "sold."

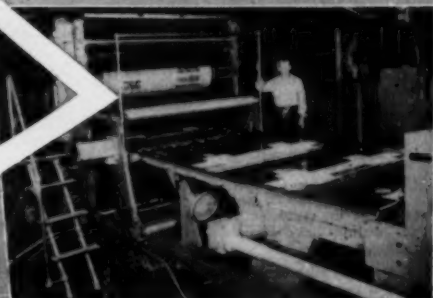
The committee method, though slower than that of the autocratic executive, does have the advantage of pooling the talents and therefore the sales resistance of several men. And its much tougher to sell an idea to a group. There is always one holdout who will heckle the proposer and harass the proposal. And he is usually characterized by an open-minded attitude of "come on . . . I dare you to convince me."

This poses a major problem in human relations for the chemical engineer engaged in either production or design work. For sooner or later he has to sell his idea to a hardfaced group of executives. Since many of this group may be non-technical men, the technical merits of the proposal

(Continued)



Rheemcote Process Gas-fired oven at New Orleans plant pre-heats, bakes and cools sheet finishes at 4,200 per hr. rate.



Rheem Manufacturing Company's giant metal offset press lithographs 3'x6' sheets of 18-gauge steel at a 4,200 per hr. rate.



color lithography on metal depends on *GAS* for processing at Rheem Manufacturing Company

Rheem Manufacturing Company's engineers worked with engineers of Wagner Licho Machinery Division to develop the GAS oven and related equipment necessary to lithograph and fabricate 55-gallon steel drums.

18-gauge steel sheets, 3'x6' are fed into the giant offset press at a maximum speed of 4,200 per hr. After printing and coating, the sheets travel through a Gas-fired 210' oven to be dried:

Pre-heat zone: 200°-275° F. for 6 min.
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Controlled cooling zone for 7 min.

After lithographing one side and lining the other, sheets are fabricated into steel drums. This Rheemcote Process permits users to identify their products in drums with familiar, colorful trade-marks. Liquid and solid materials and chemicals are shipped all over the world in these Brand-name drums.

The Rheemcote Process is an example of how GAS can be used to meet specialized problems in a production line. Gas is the ideal fuel to use, because Gas temperatures are readily controlled automatically, because Gas is clean, efficient, and economical. Whatever your requirements, learn how GAS can serve you. Call your Gas Company Representative today for the facts.

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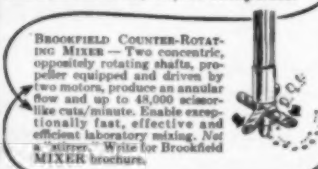
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HUMAN EQUATION, cont. . .

will fall upon bored ears, unless the pitch is well aimed.

CAN TECHNICAL MEN SELL?

Unfortunately, the average technical man is not cut out for selling either ideas or products. Data from the psychologists show that as far as interests are concerned, the salesman and the engineer are at almost opposite ends of the scale. The engineer, quite obviously falls among those individuals who prefer to handle "things" rather than "people." And like the artist a talent for creative work usually develops early in the life of the student of the pure or engineering sciences. Again like the artist, his normal development tends to pull him farther away from people-handling situations. The sales inclined person, on the other hand, ripens and improves as he grows older. This is mainly because of the increased opportunity to study and learn more about his stock-in-trade, people.

For this reason, the hybrid, who combines an interest and facility in handling both things and people presents an interesting specimen for psychologists and selling-minded engineers to study. Good examples of this type of animal are found in such fields as industrial engineering, journalism, sales engineering and the applied arts.

Upon closer examination the hybrid is usually revealed to be a person trained in a creative field, but operating in position where his daily bread is derived by handling or serving people. As such, he represents a person who has made a successful compromise between the rigors of science or art and an understanding of human frailty.

HOW THE ENGINEER CAN SELL AN IDEA

Before launching a campaign of conviction the technical man should make an accounting of his selling assets and liabilities. His greatest asset is the general respect in which he is held by people who shudder at blueprints and detest reading table of technical data. They reason that there must be something exceptional about a man who can make sense out of "all that." This respect, however, only gives the engineer an opportunity to get his foot in the door of laymen's minds. From that point on he must talk to them . . . not above them and not, by any means, down at them.

Another asset the engineer possesses is a complete familiarity with the subject. But here again, this asset might quickly turn into a liability unless the valve of his knowledge is turned on and off at the right times.

He should always bear in mind the old saw about "ask an engineer for the time of day and you'll get a lecture on how to make a watch."

The erroneous assumption that everyone in the audience is as enthralled as he about the details of a situation is a major pitfall the technical man must guard against. In this sense, a love of detail is the major liability of the technical man in trying to get over an idea to laymen. Even at the price of short circuiting his methodical thinking, the engineer should take a lesson from the ad man and "hammer at the high points."

A proposal for a new process, for instance, might offer six logical advantages. But points D, E and F might be the ones with real "sales appeal" for management, i.e., cuts costs, increases yield, decreases maintenance. These points then, are the ones to be extolled first. And A, B, and C should only be brought in if the time and patience of the audience permit.

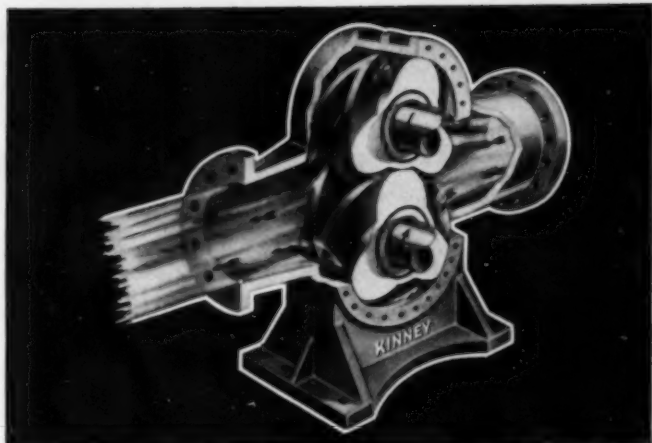
Another trait for which the technical man is damned is his reluctance to talk in generalities. By training he has been taught to build a general rule from specific cases. The layman, of course, works in the opposite direction and often to his own disappointment. But nevertheless, the average man is more interested in knowing that Compound Z is a good "paint remover," than whether or not it is better for the removal of varnish or enamel or lacquer.

An appreciation of the economic or business side of a situation is another necessity for technical men trying to sell an idea. Patent files are filled with developments that are sound technically but of doubtful commercial worth. On the other hand some technically second rate products have succeeded because of their immediate sales appeal, or commercial practicality.

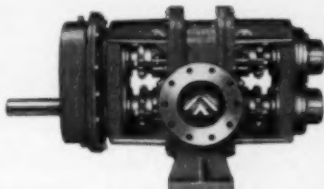
Technical men, like other creative people, suffer constantly by the criticism that they have no "business sense." Hence, it is to their advantage to introduce a sales or marketing reason into their proposals, wherever possible.

Engineers must also work to dispel the reputation they have gathered for hesitancy in the making of decisions. As one member of the board of a large company explained: "Getting a positive decision out of our engineer is like pulling teeth. He'll always give you as many reasons for not doing a thing as doing it. And when he leaves the room you have no clearer idea of what to do than when he entered."

That engineer didn't make a "sale."
—End



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A look at the record will show you why we call the Kinney Heliquad Rotary Pump "the pump you can forget". A recent survey of 1685 Kinney Pumps (average age 9.2 years) showed an average annual cost for repairs of only 1.65% of the original cost. Materials pumped

included all grades of products from abrasive crude oils to volatile gasolines, from black strap molasses to sea water. Not at all unusual was one HQA pump, in service since 1928, which had never cost the user a dime for repairs.

When you're thinking about pumps, remember the Kinney Heliquad — with its highly efficient helical rotors driven by hardened steel timing gears. Kinney engineers will gladly show you how this smooth-working, positive displacement pump can help reduce your pumping costs... and eliminate needless maintenance expenses. Send coupon below, or write giving complete details. KINNEY MANUFACTURING COMPANY, Boston 30, Mass. Representatives in New York, Chicago, Cleveland, Houston, New Orleans, Philadelphia, Los Angeles, San Francisco, Seattle, and foreign countries.



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| <input type="checkbox"/> Asphalt | <input type="checkbox"/> Distillate | <input type="checkbox"/> Molasses | <input type="checkbox"/> Water |
| <input type="checkbox"/> Caustic | <input type="checkbox"/> Edible Oils | <input type="checkbox"/> Hot Oil | <input type="checkbox"/> Others (see letter attached) |
| <input type="checkbox"/> Crude Oil | <input type="checkbox"/> Fuel Oils | <input type="checkbox"/> Gasoline | |

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MAN OF THE MONTH

Joseph C. Elgin

... new associate dean of Princeton's school of engineering after 15 years as chairman of the department of chemical engineering.

We at Chemical Engineering have never exactly thought of the *Ladies Home Journal* as a competitor but its influence on the career of one chemical engineer has been momentous. When Joseph C. Elgin entered the University of Virginia at the tender age of 16 he had never taken chemistry. The reason he enrolled in chemical engineering was that his mother had read some favorable predictions about its future in the *Journal*. Professor Elgin has never had cause to doubt the ladies' wisdom.

He made a good start at Virginia, held office as president of Alpha Chi Sigma, the chemical fraternity, and was elected to Tau Beta Pi, national honorary engineering fraternity. He went on to get his master's in chemistry, then to an assistant professorship in chemical engineering.

He worked one summer as a control chemist at the Johns-Manville plant in Manville, N. J. He boarded at the Hotel Asbestos, named after one of the important raw materials, and arose every morning in time to arrive at the plant at 7 A.M. He remembers that that summer was more or less of an ordeal but says that it provided him with some valuable experience in plant operation.

Three of Professor Elgin's chemistry teachers at Virginia had been Princeton men. He decided to study there for his Ph.D. in physical chemistry in the present operations laboratory which the chemistry department then operated. Just about the time Professor Elgin came to Princeton, its chemical engineering department really began to take shape and grow.

From 1929-1931, while he was instructor, the department developed rapidly, and while he was an assistant professor from 1931 to 1933, the AICHE accredited the department. A year after, the chemical

(Continued on p. 225)

Rolland M. Zabel. Manager of engineering Westinghouse lamp division, Bloomfield, N. J. To direct lamp engineering and development, chemical and metallurgical engineering, the activity of Bloomfield experimental factory. Joined division in 1947. For 11 years chief engineer of Sylvania Electric Products' lamp division.

J. Charles Moessinger. Executive assistant to vice president in charge of operations, General Aniline & Film Corp.; has been research coordinator for dyes and intermediates manufactured at Rensselaer, N. Y., plant. Continues as technical coordinator of foreign activities. Educated in his native Switzerland at the University of Geneva, Ph.D. 1920. Came to General Aniline as a research chemist, 1921.

Stiles M. Roberts. From associate director, General Aniline & Film's central research laboratories at Easton, Pa., to research coordinator for dyes and intermediates, Rensselaer, N. Y., plant. Studied at Texas Tech and the University of Texas.

H. R. Ayres. From assistant plant manager at Du Pont's Philadelphia works to managership of the Chicago plant. Joined Du Pont in 1919. Graduate of Drexel Institute. His successor in Philadelphia: **L. S. Baker** who has been assistant plant manager at Parlin.

A. Haldane Gee. New director of bacteriology and toxicology, Foster D. Snell, Inc. In 1946-49, managing editor of *Food Industries*, now *Food Engineering*. Previously director of development, William R. Warner Co. Studied at the University of Toronto.

William H. Kanninen. In charge of food technology department, Foster D. Snell, Inc. To work on vitamin enrichment, preservation, antioxidants, packaging. Past employers: Armour, Quaker Maid, Oakite Products, and Hoffman-LaRoche.

Charles H. Moore. Assistant to the technical director, titanium division, National Lead Co., South Amboy, N. J. For the past year: at work on special projects in the research director's office, New York.

Walter J. Manson. Vice president, Kenmore Metals Corp., Jersey City, N. J. Has been plant manager and chief engineer.

Horace H. Hopkins. Assistant to the treasurer, E. I. du Pont de Nemours & Co. Has been assistant general manager of the fabrics and finishes department since 1947. Since joining Du Pont in 1924: chemist at the Wilmington experimental station; group leader in the Philadelphia laboratory, finishes division; assistant to the chemical director then director of the Philadelphia laboratory.

David H. Dawson. Assistant general manager of the fabrics and finishes department, E. I. du Pont de Nemours & Co., in Wilmington. Has been in research, sales and management work with the pigments department since joining Du Pont in 1933 as a chemist.

Thomas G. Reynolds. Executive engineer, refinery division, Catalytic Construction Co., Philadelphia. Previous employers: Standard Oil of Indiana, M. W. Kellogg, Continental Oil, Foster Wheeler, Kellogg, J. F. Pritchard. Most recently: process engineer with United Engineers and Constructors of Philadelphia.

Douglas A. Schoerke. Chief engineer, Publiker Industries, Philadelphia. To direct all engineering and construction for all Publiker industrial alcohol plants and for its liquor subsidiaries. Previous to joining firm two years ago: plant engineer of Mathieson's operations at Saltville, Va.; chief construction and maintenance engineer, Metal and Thermit Corp.; chief engineer, L. Sonneborn Sons. Graduate of Carnegie Tech.

O. B. Hopkins. Director of a new petroleum division in Canada's Department of Trade and Commerce. To give Canada's expanding defense program top priority on available oil supplies. Continues as vice president of Imperial Oil Ltd.

William J. Weed and Louis E. Bauer. New vice presidents of Niagara Alkali Co., New York. Mr. Weed: manager of sales and a company

(Continued)

Efficient Exhaust and No Space Wasted



ROOF INSTALLATION
OF PAPER COMPANY POINTS WAY TO SAV-
INGS IN MANY INDUSTRIES

Above are part of the ten 36" "Buffalo" Type "B" Vaneaxial Fans mounted in roof exhausts of West Virginia Pulp and Paper Co., Mechanicville, N. Y. Note how the fans fit in like a section of pipe. Their light weight obviates heavy, expensive mountings, and the fans waste no space. The steam comes from hoods from Nos. 5 and 6 paper machines—and passes straight through the pipes and fans with absolute minimum resistance. (At right, note how motor is entirely removed from air stream). Whenever YOU need fans for mounting in straight duct runs, you'll save money with "Buffalo" Vaneaxials!

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VANEAXIALS

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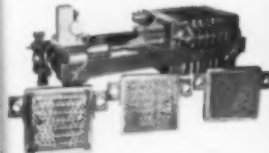
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PRESSURE BLOWING

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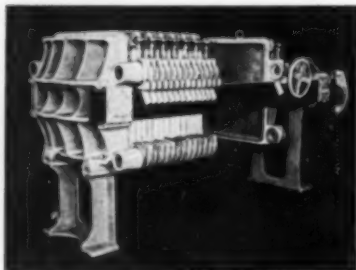
- Lowest in cost per square foot of filtering area.
- Versatile—can be used on any filterable material, no matter how heavy, thick or viscous.
- Recovers solids — reasonably dry, firm, easy to handle.
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- Made of any metal, wood, rubber, plastic for use with any filter media.



Filter press with special reinforced perforated plates and wire screen to assure free drainage; for filtering film dope at 250 p.s.i. pressure, equipped with Shriver "Hydra-Kloser."

If the slings and arrows that are hurled at the head of the filter press were to find their mark, the poor old boy would have been a little-mourned corpse long ago. But strange to say, filter presses—and Shriver makes the major percentage of them—constitute the largest selling pressure filtration equipment in the process industries today and are likely to continue so for many years to come.

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NAMES IN THE NEWS, cont. . .

director; joined Niagara in 1913. Mr. Bauer: manager of production and a company director; joined in 1917; Brown graduate.

Victor Conquest. Vice president in charge of the research division, Armour and Co., Chicago. Joined Armour in 1931 as analytical chemist; made department head in 1931. Studied at the University of Kansas and the University of Dijon, France.

John Gamble Kirkwood. Sterling professor of chemistry and chairman of the department of chemistry at Yale, as of July. Now professor of chemistry at CIT. Member of the National Academy of Science; associate editor of *Journal of Chemical Physics*, *Journal of Physical Chemistry*, *Chemical Reviews*. Previous positions at: MIT, Cornell, University of Chicago. Awards: Theodore William Richards Medal from the northeastern section of ACS, 1950; ACS Award in Pure Chemistry, 1936. Studied at the University of Chicago and MIT (Ph.D., 1929).

Frank A. Vorhes, Jr. Chief of Food and Drug Administration's division of food. Chief chemist of FDA's division of field operations since 1948; with FDA since 1928.

H. L. Haller. Assistant chief of Bureau of Entomology and Plant Quarantine. To work on insecticides and chemical problems relating to insect pest control. Previous positions: associate in chemistry, Rockefeller Institute for Medical Research; assistant leader of the bureau's division of insecticide investigations; most recently, special assistant to the chief of the bureau. Instrumental in determining chemical structure of rotenone. Studied at the University of Cincinnati and Columbia.

Elmar V. Piel. Project group leader, Evans Research and Development Corp., New York. Formerly: teaching fellow at NYU; in technical sales department, Allied's Barrett Division; chemist with Hercules and Shell. Graduate of NYU, Ph.D. in chemistry.

Ernest R. Mueller. Supervisor of organic coating research, Battelle Institute, Columbus, Ohio. Joined Battelle in 1945. For nine years previous: research chemist with the Ditzler color division, Pittsburgh Plate Glass Co.

Joseph C. Elgin
(Continued from p. 222)

engineering department became a unit separate from the chemistry department of which it had been an auxiliary up to that time. From 1935 to 1939, Professor Elgin was an associate professor. During that time, he became chairman of the chemical engineering department, and in 1939 he received the full professorship, when he was only 35 years old. The number of undergraduate chemical engineers at Princeton had gone from 15 to 175 since he first came.



A. W. Ruddy



S. T. Ellis

J. William Harlow. Head of Arner Co.'s analytical laboratory in Fort Erie, Ont. With Arner since last July; formerly with Merck in Montreal.

A. Wayne Ruddy. Director of organic chemical research, Chilcott Laboratories, Morris Plains, N. J. Formerly with Sterling Winthrop Research Institute. Studied at the Universities of Nebraska and Maryland.

Sydney T. Ellis. Assistant to the president, Commercial Solvents Corp. Formerly in charge of engineering and technical activities, W. R. Grace and Co. Graduate of Virginia Polytechnic Institute.

Ivor E. Campbell. Supervisor of research on chemical problems in non-ferrous metallurgy at Battelle Institute, Columbus, Ohio. With Battelle since 1943. Graduate of Evansville College and Ohio State.

Charles H. Sommer, Jr. General manager, Merrimac Division, Monsanto Chemical Co. Assistant general manager of the organic division since 1949. With Monsanto since 1934.

John C. Sheehan. To receive ACS Award in Pure Chemistry next month. Associate professor of organic chemistry at MIT since 1946. Known for his share in developing the Bachmann process for preparing the high explosive RDX and for research leading to the synthesis of penicillin. Research chemist with (Continued)

Performance RATINGS

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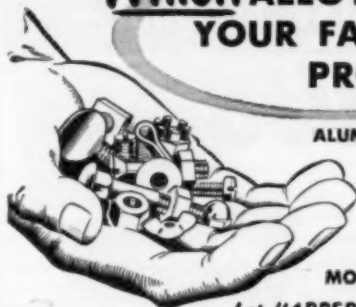


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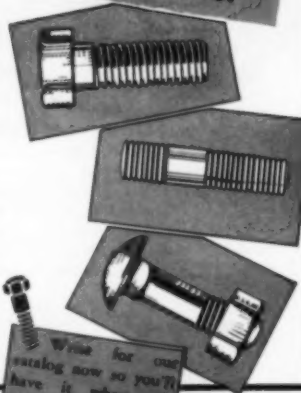
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NAMES IN THE NEWS, cont. . .

Merck, 1941-46. Studied at Battle Creek College and University of Michigan, Ph.D. 1941.

James Harrington Boyd. Visiting professor of chemical engineering, Columbia University. Consulting chemical engineer since 1947. Past positions: assistant manager, research and development department, Atlantic Refining Co.; process development supervisor, E. I. du Pont de Nemours & Co.; assistant manager, chemical products department, Phillips Petroleum Co.; assistant to the president, Hycar Chemical Co. Studied at Kenyon College, MIT, University of Pennsylvania.

Andrew A. Melnychuk. Project engineer, Omega Machine Co., Providence, R. I. To work on problems of chemical feeding. Past positions: development engineer, plastics division, Celanese; project engineer, National Biscuit Co.



A Melnychuk



J. H. Scott

John H. Scott. Assistant chief chemist, Lukens Steel Co., Coatesville, Pa. Had been in charge of spectroscopic analysis in the company's chemical laboratory. Joined Lukens in 1936.

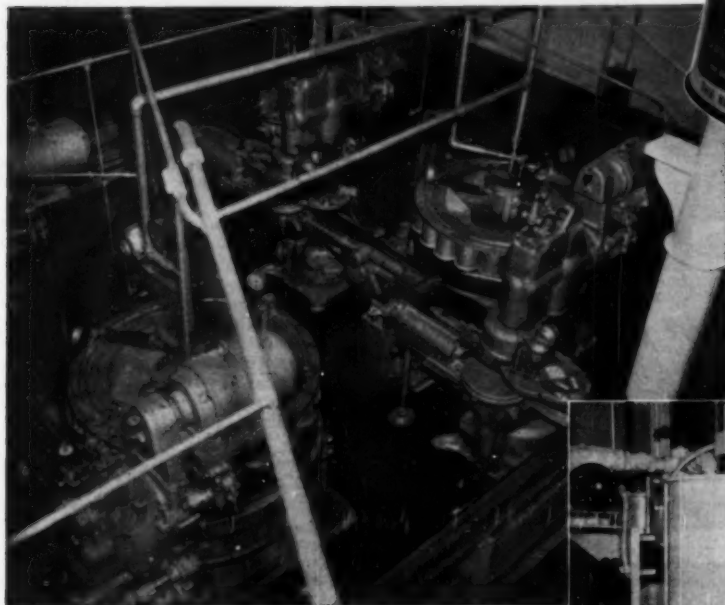
Edward J. Wasp. Chief process engineer, sales division, Petro-Chem Development Co. Has devoted the past six years to heat transfer, process problems and furnace designing for the petroleum and chemical industries.

Paul J. La Marche. General manager, National Distillers Chemical Corp., Ashtabula, Ohio; has been sales manager of two years.

William L. Nelson. Manager, technical service and development division, Great Western Division, Dow Chemical Co. Previous Dow positions: chemical engineer, physical research laboratory in Midland; in charge of East Coast solvent sales; general chemical sales, Great Western Division.

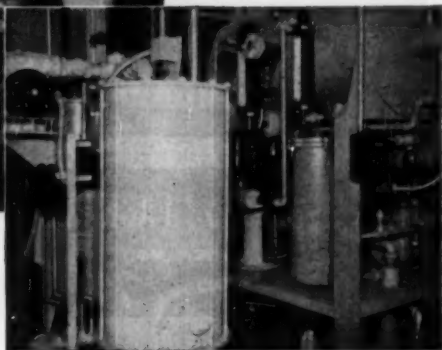
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Packaged under a DRY inert gas to preserve its freshness



These packaging machines fill the cans with powdered milk, pull a vacuum on them, flood the contents with DRY gas and then seal the cans.

Gas produced in the generator to the right passes through this Lectrodryer on its way to the packaging machines.



The Nestlé Company, Inc. makes certain their powdered milk products reach users unharmed by exposure to oxygen. Not only do they flood the contents of every can with an inert gas, but they also DRY that gas, so oxygen cannot originate from that source.

The Type BAC Lectrodryer shown above dries the gas as it comes from the generator, at the rate of 200 cubic feet per hour. The operation is continuous, since one column is reactivated while the other is on-stream, this cycle being reversed at regular intervals.

Many food, candy, pharmaceutical and chemical processing plants are holding entire working areas at low dewpoints with Lectrodryers—drying and hardening tunnels, hand and machine wrapping and packaging rooms, and the like. Work proceeds at full speed day after day, regardless of outside weather conditions.

May we show you how Lectrodryers will make your operations independent of seasonal humidity? Write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

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**LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS**

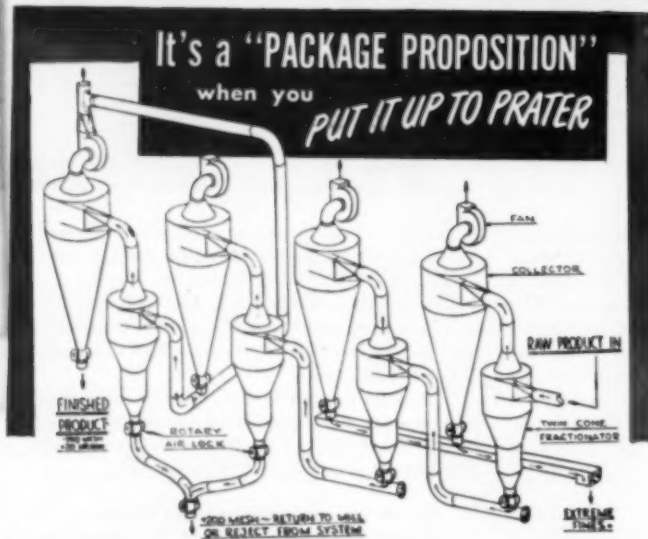
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NAMES IN THE NEWS, cont. . .

Rex E. Lidov. Director of research, Julius Hyman & Co., Denver. His successor as assistant director: Henry Bluestone.

John L. Gillis. General manager, organic chemicals division, Monsanto Chemical Co., St. Louis, Mo. Company vice president, has been general manager of the Merrimac Division at Boston since 1949. Monsanto career dates from 1933; assistant export manager at St. Louis, then export manager; assistant director then director of the foreign department.

John F. Thompson. Chairman of the board of directors, International Nickel Co. of Canada, Ltd. Continues as president. From 1906-18, in charge of the company's research and technical activities on Monel and malleable nickel and head of all field and outside plant operations. In 1921, manager of operations; 1928, assistant to the president; 1949, president.

Paul D. Merica. New member of the executive committee and the advisory committee, International Nickel Co. of Canada, Ltd. Also executive vice president since 1949. With the firm since 1919 as: director of research, associate manager of the development and research department, assistant to the president, director, vice president.

James R. Donald. Controller of chemicals for the Canadian government and head of the new chemical division of the Department of Trade and Commerce. Has been president of J. T. Donald & Co., Montreal, consulting chemist, and of Donald Ross & Co., chemical engineers. In 1916, chief inspector of explosives in the Imperial Ministry of Munitions, Ottawa; from 1939-45, the government's director-general of chemicals and explosives.

Ernest E. Ludwig. Assistant engineering manager, Dow's Texas division. To coordinate engineering on new production units. Joined the division's engineering department in 1942.

Robert L. Teeter. Manufacturing engineer, chemicals division, General Electric's chemical department. Formerly chemical project engineer for Tennessee Eastman at Kingsport, Graduate in chemical engineering of Kansas State College and Virginia Polytechnic Institute; law degree from University of Virginia.

Thomas S. Nichols



National Production Authority Administrator Manly Fleischmann reached into the nation's bag of top-level businessmen and pulled out an excellent specimen for appointment as his special assistant.

The man—Thomas S. Nichols, president and chairman of the board for the past three years of Mathieson Chemical Corp. He's taking an indefinite leave of absence.

Born in Cambridge, Md., Nichols is 42. He started his career with E. I. du Pont de Nemours & Co. For 12 years he worked in operating and sales capacities. He became vice president of the Prior Chemical Corp. of New York in 1938. During World War II he was special consultant to the director of the WPB chemical division, and was a member of the Harriman Mission to London.

It's a top-level job that Nichols is taking with NPA. No specific duties are enumerated for him. NPA officials say he will do "whatever needs to be done" to help Administrator Fleischmann. One of his first assignments last month was to preside, with Joseph S. Bates, director of NPA's chemical division, at a conference of chlorine producers to discuss a \$215 million expansion for the industry.

It is no secret that Fleischmann wants more high-caliber men around him because his operation is growing. CMP, for example, is scheduled to go into operation in about two months. Nichols appointment is indefinite, and as the NPA officials put it, "for as long as we can keep him working here." There is also the problem of having one or two understudies for the deputy administrator's job. In case anything happens to the deputy or the administrator himself, special assistant Nichols would be next in line to take over.

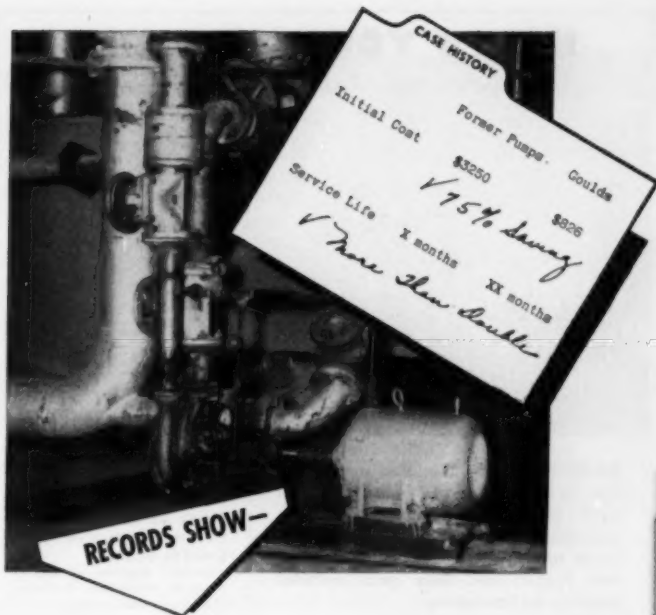
Nathan N. Crounse. To specialize on dyes and drug intermediates in the Hilton-Davis research laboratories. Graduate of Iowa State and the University of Iowa.

Raymond C. Gaugler. Elected to Manufacturing Chemists' Assn. board of directors. President of American Cyanamid Co.

George F. Thomas. President, Prater Pulverizer Co. With company 20 years.

Earl F. Arnett. In charge of the Pittsfield chemical process development section, General Electric's chemical department. Former GE positions: chemist, research section, new products development laboratory; chemical engineer, process development section, engineering division; supervisor pilot plant operations.

(Continued)



How a manufacturer cut costs tremendously with Goulds stainless steel pumps...

When handling corrosive liquids, pumps alone can be an important item in your processing budget. One alert plant engineer in the southwest cut his pump costs to about one-eighth of what they had been.

The pumps he had been using for an especially erosive crystalline slurry cost \$3250. When they wore out he replaced them with Goulds Stainless Steel Centrifugals for only \$826. But this tremendous saving in initial cost was only half the pay-off. The Goulds pumps have already been in service *twice as long* as the ones they replaced... and they're still going strong.

The advanced design and simple construction of Goulds pumps make these savings possible. Bearings are prelubricated and fully protected. Stuffing boxes are under suction pressure to prevent leakage and assure long packing life. Parts are interchangeable. The impeller clearance can be adjusted for wear. Available in 9 sizes with capacities to 750 G.P.M. Send us the coupon today for full details.



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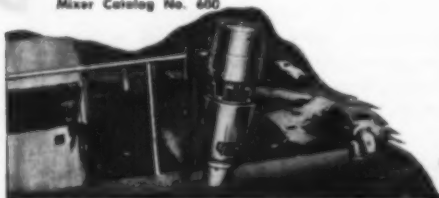
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NAMES IN THE NEWS, cont. . .

process development section. Previous employers: Three Rivers Oil Refining Co., Standard Oil of Louisiana. Graduate of the University of Texas.

S. B. Applebaum. Manager of water treatment division, Cochrane Corp., Philadelphia. Has been manager of the division's cold process section since joining Cochrane in 1949. Founder and vice president of Liquid Conditioning Corp., now a Cochrane subsidiary.

Alfred R. LaCasse. Manufacturing analyst, chemicals division, General Electric's chemical department. Has been process engineer for the resin, varnish, and compound plant. Joined GE in 1943 as an operating engineer in the phenol plant. Graduate of Iowa State College.

John T. Monahan. Assistant sales manager, safety products division, American Optical Co., Southbridge, Mass. Joined the firm as a development engineer (respirators) in 1943; transferred to sales in 1946. Studied at Holy Cross and Worcester Polytech.

C. Patrick Love. Manager of the Kaiser Aluminum and Chemical Corp. plant to be constructed at Chalmette near New Orleans. Now manager of the firm's aluminum reduction plant at Tacoma.

T. J. Gates. Refinery engineer, Torrance, Calif., refinery, General Petroleum Corp. Joined the company as pressure equipment inspector in 1946. Since 1949, maintenance control engineer. Graduate of Wayne University.

William A. Roberts. President of Allis Chalmers. Executive vice president in charge of the tractor division since 1947. With the company since 1924.

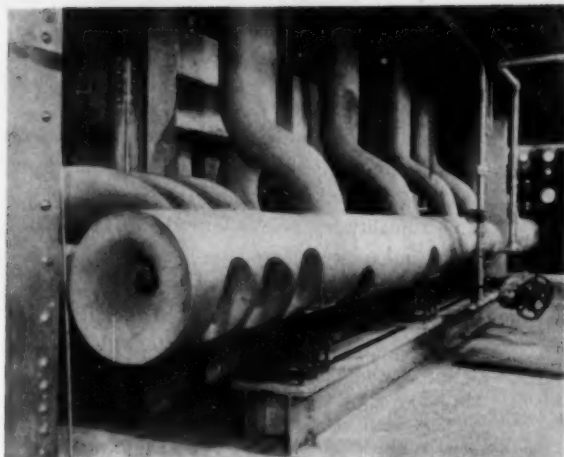
John A. Morse. Manager of operations, Plaskon Division, Libbey-Owens-Ford Glass Co., Toledo. Previously associated with: Worden & Risberg, management consultant firm; Catalin Corp. as manufacturing manager.

Kenneth D. Morrison. President and a director of NACO Fertilizer Co.

Kirk H. Logan and H. H. Uhlig. Winners of 1951 awards of the National Association of Corrosion Engineers. To Mr. Logan: the
(Continued)

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temperature
range —*

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DELIVER MORE HEAT
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Boiler and furnace header in the Riverside Power Plant, Lake Charles, La., of the Gulf States Utilities Corporation, Beaumont, Texas. **Insulation Contractors:** Armstrong Cork Company.

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"FEATHERWEIGHT" 85% MAGNESIA

Keasbey & Mattison "Featherweight" 85% Magnesia withstands temperatures up to 600° F. without loss of insulating value. It is structurally strong, yet exceptionally light in weight. Alternate heating and cooling, wetting and drying does not effect its insulating properties. Its thermal efficiency remains unaffected after years of service.

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This efficient and practical insulation combines the high heat-resistant properties of Keasbey

& Mattison Hy-Temp with the superior insulating qualities of "Featherweight" 85% Magnesia. This makes Hy-Temp Combination Insulation suitable for exacting temperature control up to 1900° F.

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INSULATION	50°F	100°F	200°F	300°F	400°F	500°F	600°F	700°F	800°F	900°F	1000°F	1100°F	1200°F	1300°F	1400°F	1500°F	1600°F	1700°F	1800°F	1900°F
DUPLEX																				
AIR CELL																				
FINE CORRUGATED AIR CELL																				
SPECIAL FINE CORRUGATED AIR CELL																				
SIMPLEX "SUPER SHRUNK"																				
"FEATHERWEIGHT" 85% MAGNESIA																				
BESTFELT																				
HY-TEMP																				
HY-TEMP COMBINATION																				

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CONNECTICUT

NAMES IN THE NEWS, cont. . .

Frank Newman Speller Award for contributions to corrosion engineering. His work: research engineer, Cast Iron Pipe Research Assn. Washington, D. C. To Dr. Uhlig: the Willis Rodney Whitney Award for contributions to the science of corrosion. His work: heading the corrosion laboratory at MIT.

Harold Hoppens. Associate director of research, Plaskon Division, Libbey-Owens-Ford Glass Co., Toledo. Continues in charge of coating resin research in which he has been engaged since joining Plaskon nine years ago. Studied at Creighton University and Iowa State.



H. Hoppens



R. D. Scott

Robert D. Scott, Jr. General manager of production for all plants of B. F. Goodrich Chemical Co., Cleveland. Has been plant manager of the firm's polyvinyl chloride resin plant at Louisville, Ky. Studied chemical engineering at the University of Kentucky and MIT. Joined Goodrich as a chemist in the rubber reclaim division, 1935. In 1940, manager of the company's first vinyl resin plant in Niagara Falls.

John L. Nelson. From production manager to plant manager of B. F. Goodrich Chemical Co.'s polyvinyl chloride resin plant at Louisville, Ky. Joined Goodrich as a chemist in 1939. Has worked in both the Akron and Niagara Falls plants. Graduate of the University of Wisconsin.

Harry M. Schadel, Jr. Metallurgical engineer on the uranium ore refinery project of Catalytic Construction Co., Philadelphia. Has been a research associate in the metals research laboratory of Carnegie Tech. Graduate of Carnegie Tech.

Henry Eyring. Winner of the William H. Nichols Medal for 1951 of the New York section of ACS. In recognition of his work on the theory of rate process in chemistry, biology, metallurgy and physics. Dean of the graduate school of the University of Utah since 1946. Has

been associated with: University of Wisconsin, University of California, Princeton, Textile Foundation. Studied at the Universities of Arizona and California (Ph.D. in chemistry, 1927) and Kaiser-Wilhelm Institute.

Ralph H. McKee. Winner of the 1951 Honor Award of the University of Maine Pulp and Paper Foundation—in recognition of his initiating and establishing the first college course of pulp and paper technology in the country at the University of Maine. Consulting chemical engineer in New York. Professor chemistry and chemical engineering at the University of Maine, 1909-16, and at Columbia, 1918-39. Studied at Wooster College and the University of Chicago.

Joseph W. Conlon. From supervisor of the azo area at the Rensselaer, N. Y., plant of General Aniline & Film Corp. to production manager of the plant. Joined General Aniline in 1936. Had been with Technicolor Motion Picture Corp., Hollywood. Notre Dame graduate.

OBITUARIES

Harold F. Miller, 49, production manager of plants of B. F. Goodrich Chemical Co., Cleveland, died in Akron February 17. A graduate of Purdue, he had been with Goodrich since 1926.

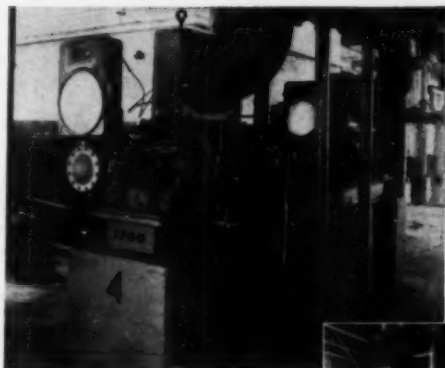
Otis Wack, 70, vice president in charge of engineering for the U. S. Gypsum Co., died in North Hollywood, Calif., February 21.

Harry H. Strauss, 67, president of Ecusta Paper Corp., Pisgah Forest, N. C., died February 27. He discovered a satisfactory method of manufacturing cigarette paper and established the plant near Asheville in 1939.

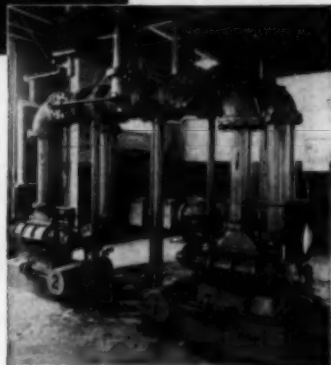
William G. Krummich, 56, vice president of Monsanto Chemical Co. and general manager of the organic chemicals division, died February 27. He had been with Monsanto since the first World War.

Irving J. Seskis, 52, president of Schenley Laboratories, died in New Orleans March 5. He headed Schenley Industries' activities in the mass production of penicillin which led to the organization of Schenley Laboratories.

Harry Publicker, 74, founder and chairman of the board of Publicker Industries Inc., died March 15.



The four meters illustrated are part of a total installation of nine R-C Meters in a large processing plant. These units measure acetylene gas sold to nearby manufacturers, who also use R-C Meters at the receiving ends. Capacities range from 3,000 cfm to 130,000 cfm.



YOU CAN ALWAYS trust R-C METERS

If you're measuring gas for production processes, you can't take any chances on quantities. If you are buying or selling it, you need cash register accuracy. You want equal precision for departmental cost accounting.

The permanent accuracy of R-C Positive Displacement Meters has long been proved for all these purposes by manufacturers and utilities which buy, sell and use gas. Four important reasons account for this unvarying reliability:

1. Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture, impurities or uncontrollable factors.
2. Accuracy is not subject to adjustment of meter or recorder by operators or other persons.
3. Accuracy is not affected by reasonable overloads.
4. Accuracy is permanent because measuring chambers are surrounded by precision-machined, cast-iron surfaces.

The 31 standard sizes of R-C Meters give capacities from 4,000 cfm to 1,000,000 cfm. They are extremely compact, permitting installation in cramped spaces. Indicating and recording instruments are available for all types. For whatever purposes you measure gas, you can permanently depend on R-C Meters. Ask for Bulletin 40-B-14 or write us your specific problem.

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INDUSTRIAL NOTES

NEW SERVICES

R. S. Aries & Associates, New York—The business of William Y. Agnew, consulting chemical engineer of New York, including general engineering and drafting offices. Mr. Agnew specializes in pigments, fertilizers and engineering design; was formerly employed by National Lead, Dorr and Imperial Chemical Industries.

Quaker Rubber Corp., Philadelphia, division of H. K. Porter Co.—The "Conservation Maintenance Plan" to help not only its customers but all the nation's industrial plants conserve vital rubber. The firm offers for the asking (Quaker Rubber Corp., Philadelphia 24, Pa.) a handbook, wall charts and monthly bulletins containing hundreds of illustrations and suggestions on how to select, install and maintain conveyor belting, flat transmission belting, hose, V-belts and packing. It's a practical approach to making the most out of rubber products which industry has on hand.

NEW LINES

American-Marietta Co., Chicago—Metal powders through the purchase of Metals Disintegrating Co., Elizabeth, N. J.

James B. Carter, Ltd., Winnipeg—Heat transfer products of Young Radiator Co., Racine, Wis. Under special license arrangements the firm will use Young designs and engineering specifications to produce units exclusively for the Canadian market.

Tracerlab, Inc., Boston—Instruments for detection and measurement of radiation through its consolidation with Kelley-Koett Mfg. Co., Covington, Ky.

Wittmann Machinery Co., Farmingdale, N. J.—Power mixers for the chemical and food industries. The line consists of models with capacities of 60, 30, 20 and 12 cu. ft.

NEW COMPANIES

John L. Dore, Inc., Houston, to mold Teflon shapes. A plant and office is now under construction at 5400 Schuler St. Mr. Dore is a chemical engineering graduate of Rice. Previous employers: Lane Wells Co.

and Sterling Packing and Gasket Co.

Central Transformer Co., Chicago, to make specialty units for control circuits, communications gear, control instruments. President is Morton R. Whitman.

Canadian Salt Co. Ltd., Montreal, to carry on the salt business of Canadian Industries Ltd. and Alberta Salt Co. which it has purchased.

Richardson-Allen of Canada Ltd., Toronto, to manufacture for the Canadian market low voltage selenium rectifiers, high voltage rectifiers, battery chargers and the entire line of Richardson-Allen Corp., College Point, N. Y., parent company.

Admiral Tool and Die Co., Long Island City, N. Y., to manufacture and sell emulsifying, mixing, homogenizing and grinding equipment. Under an exclusive licensing agreement, Admiral has taken over all processing equipment formerly made by Edwin Eppenbach.

NEW LOCATIONS

Dominion Salt Co. Ltd. has moved its headquarters from Sarnia, Ont., to Montreal.

B. F. Goodrich Chemical Co. has moved its Chicago sales office to the Board of Trade Bldg., West Jackson Blvd.

Colorado Fuel and Iron Corp. and its Wickwire Spencer Steel Division have moved their executive and New York sales offices to 575 Madison Ave.

Patterson Foundry & Machine Co., East Liverpool, Ohio, has moved its New York district office to the Empire State Bldg.

Schutte and Koerting Co. has moved its offices and plant to Cornwells Heights, Bucks County, Pa.

Hercules Powder Co. has moved its San Francisco office to 225 Bush St.

Century Electric Co. has moved its Rochester, N. Y., branch office to 224 Harrison St., Syracuse.

Distillation Products Industries has moved its Chicago sales office to 919 North Michigan Ave.

NACO Fertilizer Co. has moved its main offices to Charleston, S. C.

NEW FACILITIES

Monsanto Chemical Co.—An expansion of its new styrene plastic plant at Long Beach, Calif., which will permit more than 100 percent increase in production capacity. Work will be completed in July.

Spencer Chemical Co., Kansas City, Mo.—Further expansion of its anhydrous ammonia and nitric acid production facilities at its Jayhawk Works near Pittsburg, Kan. Completion of the program is expected the latter part of this year.

Hercules Powder Co.—A three-story addition to its main laboratory building at its Wilmington experiment station. Facilities have thus been increased by more than 60 percent; 26 new laboratory units accommodate 51 chemists.

NEW NAMES

Brooks Boiler Treatment Co., Cleveland, has changed its name to Brooks Chemicals, Inc. The new name is in keeping with the company's broadened activities which now include the field of water problems generally, detergents and degreasers, treating of fuel oils and the controlling of slag and fire scale deposits.

Food Industries, McGraw-Hill monthly, has changed its name to *Food Engineering*, a more specific and self-defining title for the magazine that serves the engineering needs of food processing plant management.

Hartford-Empire Co., Hartford, Conn., has changed its name to Emhart Mfg. Co.

NEW REPRESENTATIVES

Hansen Mfg. Co., Cleveland, has appointed the Burke Co., San Francisco, exclusive distributors in northern California for its couplings used in pneumatic and hydraulic service.

Baker-Raulang Co.'s Baker Industrial Truck Division, has appointed Material Handling Co., its representative in the Syracuse, N. Y., area.

—End

FOR **FILTERING** FUMES, DUST, SMOKE... AND SOME LIQUIDS

a superior filter fabric—
FUMEALL*

TRADE-MARK

a combination of Virgin Wool and DYNEL...

The RIGHT filter cloth for your job is now available in Portland Woolen Mills' new, longer-lasting **FUMEALL** filter fabric. Now in use by leading smelters, **FUMEALL** marks the high spot in Portland Woolen Mills' 50th Anniversary Year.

COMPARE THESE FEATURES WITH YOUR PRESENT FILTER FABRIC:

How Long Does It Last?

In actual operational tests, **FUMEALL** lasts at least 3 times as long as conventional all-wool filter fabric; on accelerated tests, 6 times as long.

Does It Have the Right Porosity?

You get exactly what you want with **FUMEALL**: the RIGHT weave for the specific job required. At present, **FUMEALL** is available in 5 different weights—from the most porous 14-oz. to the least porous 24-oz. If you need a finer or coarser weave, you can have that, too. **FUMEALL** may be napped or unnapped to vary the length of run between clearings.

Does It Have Resistance to Moisture?

In intermittent filtering operations, **FUMEALL** moisture absorption is 50% less than conventional all-wool fabrics.

This prevents considerable weight-gaining due to excess moisture accumulation.

Is It Resistant to Acids, Alkalies and Heat?

FUMEALL filter fabric is superior because it combines the proved filtering properties of virgin wool and the acid, alkali and heat-resisting qualities of **DYNEL**, a new synthetic fiber developed by Carbide and Carbon Chemicals, Division of Union Carbide.

Tests to date show that **FUMEALL** operates perfectly in heat ranges up to 350° under certain acid and alkali conditions. Further tests are now being made in higher temperature ranges.

Are You Getting the Size You Want?

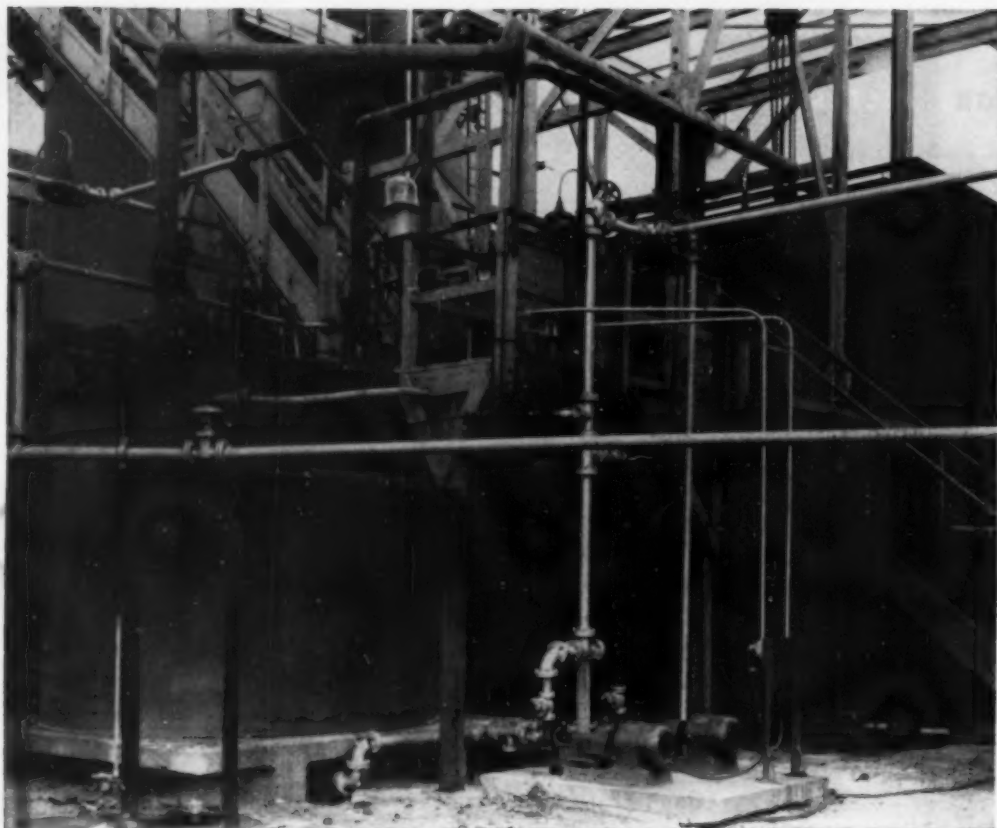
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It's significant that LaBour pumps are so widely preferred in the manufacture of sulfuric acid. The photograph shows a pair of LaBour DZT pumps in a contact operation. LaBour pumps of this and other types are commonly used for the manufacture and transfer of sulfuric acid.

If you are a user of sulfuric acid you can

profit by the experience of those who make it. Continuity of operation is dependent not only upon the use of proper corrosion resistant materials but upon the selection of the proper pump for the service. Today's LaBour pumps are the product of 28 years of dealing with such problems. That is why you can depend upon them.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

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Manpower

It is industry's top problem. And management all along the line is putting its best minds to the task of finding immediate and long-term solutions. Here are some ideas from a recent conference.

The Crisis¹

At no other time in our history has there been a greater need for marshalling the engineering talent of this country to help resist and overcome the threat to our democratic way of life.

This is the machine age and the machine has become very complex through reasearch and development by the engineer. It was the machine and the efficiency and skill of our engineers and production men that helped shorten and win World War II. In the present emergency, it will be a basic battle of men and machines. The country that can provide its fighting men with the most efficient equipment to meet the existing circumstances will certainly have the edge.

THE SHORT HAUL

Stop the Waste²

One way to ease any emergency is to really get tough with any waste

¹ Footnote credits for the papers herein abstracted, will be found at the end of the symposium (p. 244).

problem. Government owned and operated laboratories are one such offender. Specifically, the great increase in the number of these government laboratories is alarming. It's been said that every privilege has a responsibility. Certainly Government ought to think twice before putting further taps on the emptying manpower barrel. Here are some undesirable results certain to stem from this trend.

1. The efforts to staff such additional laboratories would inevitably drain from the universities and engineering colleges their key men. This would result in inadequate utilization of the great mass of technologists of intermediate abilities left behind on college campuses because of loss of leadership of the key personnel. It would also undoubtedly have a serious effect on the training of engineers and scientists.

2. It would divert a certain amount of technical manpower to the design, construction, and equipment of these laboratories, while university laboratory facilities lie idle.

3. The time required for construction of such laboratories would cause a lag in the full utilization of the technical manpower which we now have.

The present emergency has created a need for scientific and technical personnel in government, principally the Department of Defense, whose impact has not yet begun to be felt and whose magnitude is consequently probably not fully realized. A rough estimate of the magnitude of this need can be obtained from the following: during the fiscal year 1949 the Department of Defense spent about \$550 million on research and development and the AEC spent about \$300 million. These efforts utilized respectively about 67,000 and 28,000 scientists and engineers.

The most recent figures for the present fiscal year indicate that the Department of Defense will spend about \$1,050 million on research and development and that the AEC will about double its effort. This means that when these moneys are committed, the requirements for technologists in these two governmental defense efforts will be just about doubled. Since the AEC and the Department of Defense represent by far the major part of the government

(Continued)

money spent for research and development, this means that the over-all governmental requirements will be about doubled.

Plug the Drains²

What conclusions can be drawn from these facts and figures? Most certainly it is apparent that industry, government agencies, including military will have to have a closer working relationship to obtain a maximum utilization of all available technical manpower. Without this coordination there will be a duplication of effort and a probable resulting waste of engineers.

We in industry must re-examine all technical job classifications and where possible break these jobs down to permit the replacement of engineers with non-technical personnel. It will undoubtedly be necessary to re-establish special training programs to prepare women for such work as drafting and assisting in laboratories.

Above all it is vitally important that the military establish a policy of assuring the continuance of engineering education to meet the expanding needs of industry and government. Such a policy should encourage and permit increased enrollment of engineering students; it should guarantee the graduation of qualified students; and it should allow industry a fair share of the engineering graduates. Moreover the military must realize its dependency on industry and therefore also adopt a policy of permitting industry to retain its experienced engineers.

Can We Train More?³

Industry needs an estimated 20 to 25 percent more graduate engineers on its training programs than ever before in the history of the United States.

We must train more engineers because of the amount of work which we have in our shops today. It is useless to say that we can get along without them. The lack of technical people is an important reason for delay in shipments, designs, slowness of maintenance.

There has been a recent trend to train young graduate engineers directly for production rather than for application. The pressure has been to get the things out, and bowing to this pressure, it was necessary to accede to the luxury of really good training.

Face Facts⁵

There will be fewer training programs for the following reasons.

1. There will be a shortage of engineering graduates due to smaller graduating classes, more men going into the armed services, and an even greater demand for technical men in industry.

2. With smaller groups of engineers available, there will be increased pressures within all industries to get the men on the job and make them productive as quickly as possible.

3. Graduates themselves may be less interested in training programs in a period when progress in industrial concerns is likely to be rapid, and when there will be considerable competition for available manpower.

4. Draft Boards may be unwilling to defer men who are placed in a training course rather than in jobs which have been classified as essential to the defense effort.

5. Supervisors and others responsible for carrying out portions of the normal orientation and training course will be under greater pressure to do other things, and may be less willing to take on additional training burdens.

6. Most industrial concerns which have had orientation and training programs for many years, increasingly recognize their value, and will be loath to eliminate them entirely for the very practical reason that well-designed training courses have proved to be the quickest way to develop thoroughly productive men and at the lowest overall cost.

Considering the above factors, we can draw several conclusions.

First, industry will have to recognize the realities of the deferment policies established by Draft Boards. If needed engineers cannot be deferred while they are on training programs, industries can hardly afford to lose what few men they will get by not immediately putting them on jobs which will insure their deferment.

It seems probable, however, that there will be engineers available who are deferable for other reasons—such as having already served in the armed forces, or lack of ability to meet physical requirements for combat duty. These men, at least, will be available for training programs in many companies.

Second, training courses will need to be adapted to the changing conditions with which we are faced. Training directors are already reviewing their courses to cut down the over-all time to a practical minimum to eliminate any unnecessary social elements

which may have been appropriate in less critical times, and to make certain that the basic objective is achieved—that of getting the man acquainted with his new organization and equipped with the necessary preliminary information to allow him to become productive in the shortest possible time.

Third, the fact that fewer trainees may be available will also be a factor in determining the kind of training course which progressive industries will use. It may be impractical to rely on classroom work, lectures, or discussion groups as much as formerly, and instead to depend more on guided work experience and personal interviews along carefully-planned lines. Training courses are likely to be made specifically for the individual, with careful consideration of the job for which he is being prepared.

THE LONG HAUL

Teach the Teachers⁶

Professors in engineering schools should spend a year in industry, and we at Du Pont will provide places for some of them.

We will take into the Du Pont engineering Department, several professors from engineering schools. We will give them 12 months experience throughout the company's entire engineering organization. And we will pay them their regular salaries plus reasonable expenses.

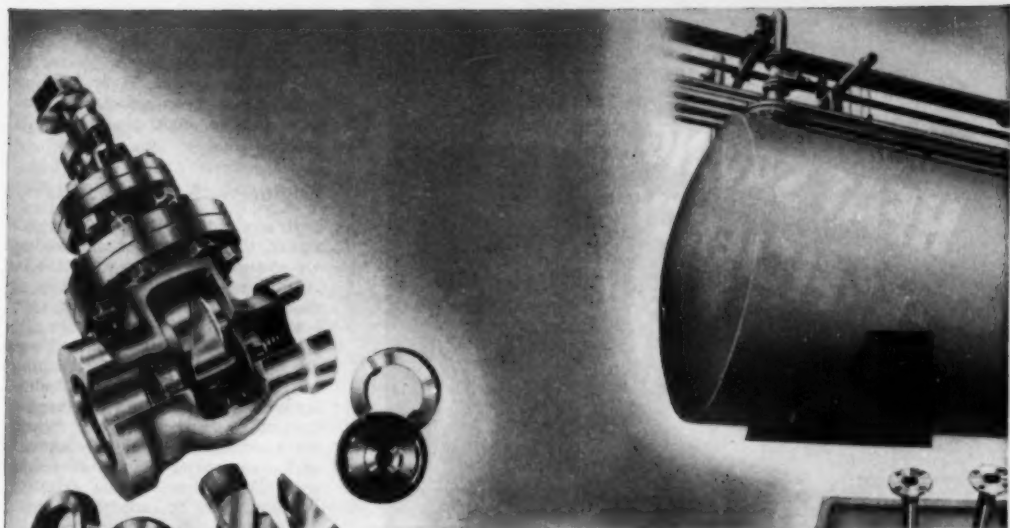
The specific details have not been worked out, but industry has a profound interest and responsibility in contributing to the support of colleges and universities.

Today an engineer has many fields in which to practice his chosen specialty, but his training would be made a lot more valuable if those who teach him were aware of the viewpoints and problems of industry. In the Du Pont engineering department alone, one can find about 100 different branches of engineering supported by a well-rounded group of engineers with specialized knowledge in many fields.

There is an even more urgent need for broad-gage executive leaders with vision and a goodly quantity of the humanities. It is my belief that the key to quality leadership for our nation and its industries is in the hands of our colleges.

But to use this key successfully, our colleges must clearly understand their problem, not as it used to be, but what it is today and will be to-

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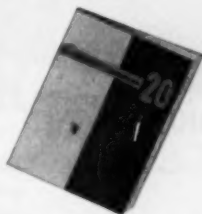


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QED, cont. . .

morrow. One of the best ways to acquire this insight, is by working with industry and absorbing its know-how and an understanding of its problems.

Engineers, Not Specialists⁷

It is decidedly important to recognize that colleges of engineering are primarily engaged in education in its true sense and only secondarily in training men for industry. In fact, I want to go further and emphatically state that as near as I can tell, we are not and should not be training men for industry. In general, industry does not want us to give a narrow training. Nevertheless, I have heard, again and again, the subject discussed of training engineers for this or that particular small segment of industry. Nothing could be further from true education.

All those directly and indirectly connected with colleges of engineering are continually being asked to add this or that piece of a course to the curriculum. The danger of this is not as great now as 20 years ago, but subject matter can never be as important as the ideas and ideals, the methods and the nature of their development.

I like the quotation given by President Doherty from A. N. Whitehead, in which he says:

"Education is the acquisition of the art of the utilization of knowledge. This is an art very difficult to impart. Whenever a textbook is written of real educational worth, you may be quite certain that some reviewer will say that it will be difficult to teach from it. Of course, it will be difficult to teach from it. If it were easy, the book ought to be burned; for it cannot be educational. In education, as elsewhere, the broad primrose path leads to a nasty place. This evil is represented by a book or a set of lectures which will practically enable the student to learn by heart all the questions likely to be asked at the next external examination."

Reorganize for Research⁸

These are the problems of the universities:

1. Government is taking the best scientific minds from the universities.
2. Industry will try to hire away the teachers.
3. Engineering students are declining to the point where a scant 16,000 will be graduated in 1954.
4. Added to these circumstances, UMT will further drain off the enrollments.

In thinking of the varied aspects of the matter, I have hit upon what may be a partial solution to one phase of the problem. Universities and colleges are playing an important part in the military Research and Development Program. The chances are that under an expanding defense program, additional R and D contracts will be planned for which prospective contractors are not immediately available. Furthermore, the research and development which will take place in the next few years will emphasize the completion of items already on the drawing board, and the development for production and use of items well on their way to completion. The demand for engineering skills will therefore be high. As I see it, the engineering schools can meet the problem in part by organizing research teams and seeking R and D contracts from the military. Not all teachers are capable research men, of course, but where there are people with this type of skill the opportunity exists for forming a really effective team on home territory made up of persons whose working ability is known to each and who function well as a team.

Where contracts can be obtained, the school can be assured of financial means of maintaining its teaching staff over the period of crisis until enrollments are once more normal. Under the proposed manpower legislation approximately three years would be required before the first UMT recruits had served the required length of service and could resume the normal course of their education.

I should like to be able to assure you that all proposals for R and D contracts forwarded to the Pentagon would receive immediate consideration and an indication of the possibility of a contract. Unfortunately, however, there is at the present time no centralized mechanism for handling any considerable volume of inquiries. Although information on procurement contracts is now pretty well centralized in one office, the letting of R and D contracts is a matter for the decision of technical branches of the Army and Air Force and the individual bureaus of the Navy. The Research and Development Board is interested in the matter, however, and

(Continued)

IT STRETCHES

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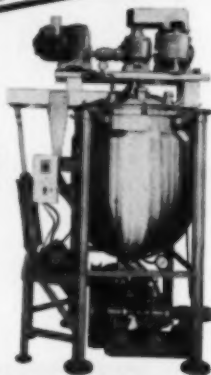
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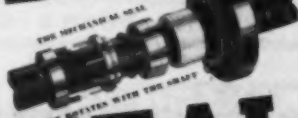
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QED, cont. . .

is presently exploring the possibility of developing a central information office for R and D contracts which would serve the same purpose as the central office for procurement contracts. Such a mechanism cannot be set up overnight, of course. In the meantime, anyone who cares to write the Research and Development Board regarding the matter will receive the personal attention of a member of my staff and can at least be sure of obtaining information which will enable him to make the rounds of the proper offices in the three services.

Admittedly it is not an ideal arrangement, and if your inquiries should seem to become tangled up in the familiar red tape, I hope that you will bear with us and retain your interest until we have established a procedure whereby the "buyers and sellers" are brought together in a satisfactory fashion.

Graduate Your Students⁹

What are the factors which effect the university's holding power of its students? We know that most engineering students come from the upper third of their high school class, yet a large percentage of them fail to graduate. Most of this loss occurs during the freshman year.

Do we fail to stimulate interest?

Do we fail to dramatize courses with every day life?

It can be assumed that at least one-fourth of this loss is due to lack of interest, and at least one-fourth due to lack of finances. Also, are all the high school graduates interested in engineering, financially able to start in college?

Perhaps industry should consider more scholarships. A \$300 per year scholarship would go a long way to helping and 10,000 scholarships would only cost industry as a whole, over the United States, three million dollars a year.

Because we need more scientific methods of warfare, more production of goods, and not millions of foot soldiers, industry and universities should crystallize some of the following ideas.

1. More technical students allowed to finish their education.
2. More students in all fields, especially business, be allowed to finish.
3. More graduate degrees.
4. No discrimination of minority groups. We should deal with the individual, not religion, color, race, or sex.

Many boys of my acquaintance are
(Continued)

how to chemically deactivate process water...



the *Versenes**

WATER IS A CHEMICAL

Ordinary process water must always be regarded as an *active chemical*. Only c.p. water is an *inert ingredient*. This is why it is always necessary to consider ordinary process water as a chemical in itself. Those who fail to do this are often confronted with many troublesome contamination problems and complaints.

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QED, cont. . .

quitting college and others are not even enrolling as freshman because of the uncertainty and confusion.

If boys are not drafted until they are 19, a year or even two years of some kind of training could be acquired before military service. They would be better men for the armed forces and better citizens when they returned.

Industry should demand and support the training of women so they will be ready when needed. During the last war, in addition to Engineering Science Management War Training, and evening courses, Purdue trained many for engineering aides and inspection jobs: (a) 137 cadettes were trained for Radio Corporation of America; (b) 258 for Curtis Wright; and (c) 300 for Wright Field at Dayton, Ohio.

These women rendered excellent service to the industry and some of them remained to work after the emergency was over.

My sympathy is with this young group of people; they are confused and are trying to plan a future. Again I say, it is the duty of colleges and industry to crystalize a program, for their good, for our good, and for the good of these United States.

All of the foregoing material has been excerpted from papers presented before the Second Industry-College Conference, Case Institute of Technology, Cleveland, Jan. 20, 1951. Appropriate credit by speaker, follows.

1. Edward N. Cole, General Motors Corp.
2. Robert F. Rinehart, Case Institute of Technology.
3. David Thomas, Goodyear Tire & Rubber Co.
4. John Gammell, Allis-Chalmers Manufacturing Co.
5. H. K. Breckenridge, Engineers Council for Professional Development.
6. Granville M. Read, E. I. du Pont de Nemours & Co.
7. F. M. Dawson, College of Engineering, State University of Iowa.
8. Eric A. Walker, School of Electrical Engineering, Pennsylvania State College.
9. F. Lynn Cason, Purdue University.

SUGAR

... New Clarification Process

Greater recovery, higher polarization, faster processing time, lower in-plant inventories, and fewer boiling-house troubles are reported achieved with a new sugar clarifying process. It is in successful operation at the Grove Farm Co.'s Koloa Mill in Hawaii.

The technique, known as the Elguanite process, was developed by J. J. Naugle president of Elguanite Corp.

Milk of lime, which since 1685 has been the usual sugar defecator, has

(Continued)

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FOR MEN CONCERNED WITH **COLOR**

How floor covering manufacturer solves tough pigment problem

A large manufacturer of floor covering materials for many years purchased an imported red iron oxide. This oxide was used in coloring linoleum.

Uniformity of quality, as well as close limits of tolerance on color, tint and strength were part of the specification.

Trouble arrived when the imported oxide became contaminated with foreign matter which made it necessary to screen each shipment. It also varied considerably in tinting and strength characteristics. This made necessary frequent formula changes.

The floor covering manufacturer came to Williams with the problem. A substitute pigment was developed which met the manufacturer's specifications perfectly . . . and manufacturing control was established to hold the product within necessary tolerance limits.



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OF MONEY . . .

"Military research and development and atomic energy research and development now account for nearly two-thirds of the national expenditure for research and development."

ERIC A. WALKER, Dean
School of Electrical Engineering
Pennsylvania State College

QED, cont. . .

been the usual sugar defecator, has been replaced in the new process by a dry white powder made up of specially processed earth metals, in the form of carbonates, hydroxides, and oxides, and a number of trace elements. The powder acts on the cane juice as a clarifier, precipitating agent, and filter aid. It performs both as an absorber and as an adsorber.

Treatment with the powder produces a brilliantly clear juice. The reaction forms a flocculent precipitate of the organic impurities. To these cling the organic materials simultaneously thrown down as microscopic nodules in a discontinuous structure. Impurities are filtered out.

Raw mixed juice is fed to the surge tank, then to the mixing tank. Powder is fed into the mixing tank from a Gravimetric feeder, which adds a quantity equal to 24-3 percent of the soluble solids contained in the juice.

Treated juice is heated to 79-95 deg. C., pumped to contact tanks, then to the hydromatic primary filter. Timer interval from heater to filter is 10 min. The filter removes the flocculent precipitate. From 70-80 percent of the color is removed at this point.

Filtered juice is mixed with phosphoric acid to reduce the pH to 7.2-7.5. It is then reheated to 83-93 deg. C. and pumped to contact tanks and the secondary filter to remove the fine flocculent precipitate of insoluble phosphates that has formed. The second filtration improves color still further and reduces ash content. The clear juice is then sent to the evaporators.

Among processing advantages of the new process is that the raw sugar presents a substantially improved product for the refiner. Ash content is reduced, the adhered molasses film on the sugar crystal is practically eliminated, the sucrose crystal is harder, all of which creates simpler, less costly processing. Keeping qualities are improved, and storage deterioration is reduced.

Less blackstrap molasses results from use of the powder clarifier. The molasses contains one-third less sucrose, thereby accounting for part of the increased yield.

... AND MEN

"The Atomic Energy Commission and the Department of Defense engage the services of about two-thirds of the nation's scientists and engineers."

ERIC A. WALKER, Dean
School of Electrical Engineering
Pennsylvania State College

Purity of the powder-processed sugar represents such an improvement that 98.5-99.2 deg. raw sugar is practical. Koloa Mill's washed raw "A" strike dried sugar has shown a polarization of 99.87. If desired, powder-processed sugar can be washed with a little water in the basket and dried to a practically white condition.

A definite advantage of the process is that less scale forms in the evaporators. Most of it is in the first body. The scale is soft, friable, and easily removed without use of caustic.

Sirups going to the pan floor are light colored, clean, and of low viscosity. This results in better pan boiling, better circulation in the pans, and quicker strikes.

From the McGraw-Hill Digest, for March 1951. Original article: *Food Industries*, Jan., p. 88.

SOLVENT REMOVAL

... Cheaper, Purer, Oil

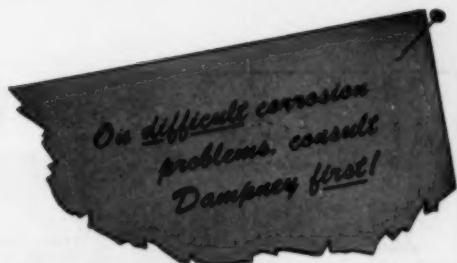
L. K. Arnold and R. D. Ingebo

Lower cost cooking oil may result from studies by two Iowa State College chemical engineers who found that solvent-extracted soybean oil can be purified more efficiently by using stripping columns packed with rolled spiral weave conveyor belting material.

Soybean oil, used on a large scale in salad and cooking oil, vegetable shortening and margarine, is mostly produced by extracting it from the beans with a solvent which must then be removed to produce a pure edible oil. This is done by blowing steam through the oil-solvent mixture which is passed through a tower packed with materials that will help expose as much of the oil as possible to the steam. The fewer passes and the less steam required to make pure oil, the cheaper the oil will be. The new packing material promises to double the capacity of solvent-stripping plants, cut the steam consumption in half, and produce a very pure oil.

L. K. Arnold, Iowa State College, and R. D. Ingebo, National Advisory Committee for aeronautics, before the American Institute of Chemical Engineers, Columbus, Dec. 6, 1950. —End

118-1



Problem: TO PROTECT METAL AGAINST
2½% CaCl₂ and 2½% NaCl
DISTILLED H₂O
WEIR POND WATER

Solution: DAMPNEY Vinyl Coating

TRIAL-AND-ERROR SELECTION COULD COST YOU 4 COATING FAILURES IN 5

An independent laboratory test of 24 coatings manufacturer-recommended for such service produced these results:

At end of
3000-hour test,
DAMPNEY
VINYL COATING
showed no sign
of failure

HOURS	2½% CaCl ₂ and 2½% NaCl	DISTILLED H ₂ O	WEIR POND WATER
3000			
2500			
2000			
1500	12 FAILED BETWEEN 180 AND 2128 HOURS	12 FAILED BETWEEN 704 AND 2460 HOURS	15 FAILED BETWEEN 102 AND 2460 HOURS
1000			
500			

- Only 5 of the 24 coatings passed all three tests.
- Among the 5 successful coatings, the average life-cost factor — or cost of protecting 100 square feet of metal for each hour of the test — ran as high as 0.85¢. Dampney Vinyl Coating's life-cost factor was 0.20¢.

Dampney Vinyl Coating is a vinyl chloride-acetate formulation of high moisture and chemical resistance adaptable to service under severe and widely varying corrosion conditions. It typifies Dampney's individualized approach to your protective

coating needs — with products engineered to meet highly specialized industrial maintenance requirements.

You'll find it pays to give yourself the benefit of a Dampney recommendation . . . first.

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Recovery of solvents at efficiencies as high as 99% is typical of Stokes Vacuum Drying equipment.

Temperatures for drying are often held as low as 100° F. Thus heat-sensitive materials such as plastics,

aluminum pastes, metal powders, and pharmaceutical dregs are dried and separated from their solvents without the impairment of chemical and physical properties which occurs with atmospheric heating.

Reynolds Metal Company at Louisville, for example, uses Stokes Rotary Vacuum Dryers for drying finely divided aluminum powder. Drying is uniform throughout the batch, efficient and economical. Solvent is completely recovered and there is no oxidation of the dry powder.

Important, too, is the freedom from fire and explosion hazards. Fine dust and solvent vapor do not mix safely with oxygen. Without air there is no oxygen; hence the danger of combustion and explosion is eliminated.

Cooling jackets permit cooling before discharging if desirable.

Stokes is the only manufacturer of complete vacuum systems . . . Stokes engineers are experienced counsellors ready to work with you on any application of Vacuum engineering.

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How You Can Become a Big Shot

If you are a little shot and want to become a big shot, you can. If you are already a big shot and want to stay that way, you can too.

Perhaps some circumstance has lifted you from a little-shot to a medium-size or even to a big-shot position. There's hope for you too.

Anybody can bootstrap himself upwards. All it takes is a pinch of guidance and a real slug of work. The work is up to you. The guidance can come from any one of a hundred books.

Most recent, and one of the better books to steer you on your way is James Bender's.*

There are, according to Dr. Bender, ten things to do: analyze yourself, streamline your mind, be a pleasant boss, grow as a speaker, improve your reading habits, master the interview, conduct excellent conferences, be a good psychologist, get the most out of your physique, stay tuned to modern leadership.

Analyze Yourself. Assuming the first step is past—you've decided to

be a leader—the next thing is to submit yourself to tests. Find out if you are leadership material. Discover how much revamping your personality and habits need. There are two kinds of tests: those given you; those you take yourself. The former with professional interpretations are the more reliable.

Streamline Your Mind. Ability to think has been found to be near the top of lists of requirements for success. Leaders are strong on five points: word power, information, memory, ability to make sound decisions, the habit of reading widely. Bender has quizzes to test your vocabulary, rules to simplify your speech and writing, steps to take toward a more powerful memory, hints toward sounder decisions and lots of recommended reading. This pinch of guidance is generous.

Be a Pleasant Boss. Courtesy—whether you think so or not—pays off. And watch your moods, too. You can chart these, you know, and take advantage of their swings. You must have empathy, follow the ten commandments for leaders, watch the three taboos.

Grow as a Speaker. The higher you go, the more often you will be called upon to make formal speeches—especially speeches of inspiration and these lean heavily on conviction. You must get rid of speech defects. The best way to begin is via recordings of your own voice. Compare with the 15-point check list of basic speech factors. Then jump at all chances to speak. As you climb the leadership ladder, the more adept you will have to be in all speaking situations.

Improve Your Reading Habits. Read for relaxation. Read for general information. Read in the field of your work. Learn to skim. Learn to read analytically.

Master the Interview. The interview has three aims: to give information, to get information, to change attitudes and behavior. Do: Be friendly, watch your manners, be composed, speak clearly. Don't: Take unfair advantage, keep him waiting. Just as there are ten commandments for leaders, there are ten for the interviewer. Other pointers include listening well, allowing enough time, observing, privacy.

Conduct Excellent Conferences. Set the stage properly. Include a re-

cess. Keep the number down—seven is ideal. Be a good speaker. (That again!) Follow the basic rules: keep conferences at ease, make a good opening speech, define your terms, encourage the timid to talk, squelch the eager beavers without hurting feelings, discourage private discussions, use mechanical aids, be polite, sum up.

Be a Good Psychologist. Respect selfish interests. Remember good humor is a powerful element. Satisfy curiosity. Make them feel secure. Talk to followers—praise, you know, is preferred. Cultivate popularity and seek help.

Get the Most out of Your Physique. Leaders are all shapes and sizes. But all humans can be divided into three types. Find out your type and the peculiarities. Learn to eat, sleep and vacation.

Stay Tuned to Modern Leadership. Learn whether leadership is a specialized ability, whether organizations are usually unified, whether the leader's influence is constant.

You see that it looks fairly easy to become and remain a good boss. Essentially, according to this authority, it boils down to but two things to consider: (1) you; (2) him.

You must find out about yourself, improve your mind and reading habits, (Continued)

* *The Technique of Executive Leadership.* By James F. Bender. McGraw-Hill Book Co., New York. 291 pages. \$3.50.

Bender Says:

"The world's scarcest species is the leader."

"Leaders don't make the highest scores on intelligence tests."

"Responsibility is a double obligation: obligation to do the job assigned to you; obligation to the one who gives you the assignment."

"Organization, responsibility, incentives, morale, cooperation, 'politics,' and statesmanship are important aspects of leadership."

"Leadership is worth a lot of self-discipline."

"Approximately fifty percent of the population can succeed fifty percent of the time in at least fifty percent of the vocations."

"Perhaps the leader's greatest responsibility is to build up morale and maintain it."

Others Say:

"Remember these three keys to success: desire, determination and a plan of action. But the greatest of these is desire."

CLIMBING THE EXECUTIVE LADDER
By G. J. Kienle & E. H. Dore

"90 percent of all supervisors won their promotions by hard work, loyalty to employers and day-by-day display of good, common horse sense."

HOW TO SUPERVISE PEOPLE
By A. M. Cooper

"You will make the most rapid progress if you realize your own shortcomings."

HOW TO SUCCEED WITH PEOPLE
By R. W. Wetherill

"You will have no more important job as an executive than that of dealing with people."

DEVELOPING YOUR EXECUTIVE ABILITY
By Howard Smith

BOOKSHELF, CONT.

take care of yourself and keep up-to-date. (Chapters 1, 2, 5, 9, 10.) That takes care of you.

You must become more pleasant and a better speaker, interviewer, psychologist, conference leader. (Chapters 3, 4, 6, 8, 7.) That takes care of him.

This rearrangement of Dr. Bender's sequence is unfair to him perhaps. But it emphasizes the points he makes. His quizzes, recommendations, anecdotes, definitions might well serve to introduce you to the literature of executive leadership. They could start you toward that executive swivel chair if—after savoring the pinch of guidance—you're sure you want it.—LBP

Nine Backs

THERAPeutISCHE CHEMIE. Von Prof. Dr. Theodor Wagner-Jauregg. Medizinischer Verlag Hans Huber, Bern, Switzerland. 272 pages. 37.5 Swiss francs.

Reviewed by Edgar A. Steck

The author of the volume at hand is well qualified to discuss the chemotherapy of infectious diseases through a number of years of experience in the art. While the size of the work would hardly permit penetrating coverage of the field, the results are in proper proportion for handy reference. The frequent occurrence of insect vectors in disease has led to considerable discussion of insecticides. General development of the separate topics has been aided by the inclusion of historical and biological background.

There are reasons for considering this a useful guide in uncovering the general trends of research in recent years, particularly those in Europe; the indexes are a special feature of this. On the other hand, the experienced American practising chemist may be confused with the names given products, and will find little more than review for his German at a high price (about \$9).

Bare Facts

PHYSICAL ASPECTS OF ORGANIC CHEMISTRY. Fourth edition. By William A. Waters. D. Van Nostrand Co., New York. 539 pages. \$8.

How have the theories of organic chemistry developed historically from each advancement of knowledge of atomic structure? In answering this question the author has made the ex-

perimental facts, both old and new, stand out; the various conceptual angles from which they have been approached have been relegated to the background. A reconciliation has thus been effected between the viewpoints of the organic chemist who focuses on the reactions of his substances and the physical chemist whose prime interest is the static study of structure.

We have traced for us the continuing progress of chemical affinity, valency bonds, molecular structure, electrical dipoles, chemical reactivity, unsaturation, free radicals. This completely rewritten edition also brings up to date ionization and ionic reactions, radical-catalyzed reactions, acidity, general polarity, substitution reactions of organic halogen compounds, ester hydrolysis and esterification, ionotropic change, molecular rearrangement, reactions of conjugated systems and aromatic compounds.—FA

Three Audiences

PROTECTIVE COATINGS FOR METALS. By J. W. Gailer and E. J. Vaughan. Charles Griffin and Co., Ltd., London. 261 pages. 24s.

Reviewed by A. H. Pope

This book describes the more important of the various films or coatings which are applied for the protection of metals. Theory and methods of application are discussed but, for the most part, not sufficiently to more than familiarize the reader with the general nature of a given process. The 223 keyed references compensate in

part for the lack of detail inevitably found in such a short book.

About a quarter of the text is devoted to inspection and test procedures with detailed methods for each type of coating. Also included is a comprehensive 25-page table listing all major coatings with seven columns of properties, etc.

It is a bit difficult to fathom just what audience the authors are trying to reach. However, the book can be recommended to three groups of people: (1) metal finishing men looking for substitute coating outside their normal line of operation, (2) technical men may use it as a reference when called on to answer questions by a boss who expects him to know all fields; and (3) inspectors and testers involved in the evaluation of protective coatings for metals.

The authors are to be commended for presenting their work in clear language and an interesting fashion.

Model Laws

MODELLGESETZE DER VERGASUNG UND VERHUETTUNG. (Model laws in gasification and metallurgical processes.) By Sergei Traustel. Volume 4 of Scientia Chimica. Akademie Verlag, Berlin. 88 pages.

Reviewed by Max F. Wulfinghoff

The aim of the author is to present, in an orderly fashion, those physical and chemical relationships which a process engineer might use in the development and evaluation of equipment in which chemical reactions and physical phenomena occur simultaneously, as in the processing of fuels (gas producers, etc.) and ores (blast furnaces, etc.). To this end, the booklet offers, in addition to an excellent introduction, and a review of general model laws, an exposition of pertinent concepts of chemical kinetics, together with such physical kinetics as enter into the discussion. The applicability of the Reynolds and the Guldberg-Waage moduli is appraised. The work of Bishop, Saunders and Ford, Kling and others received careful consideration. Specific questions treated at greater length include reactions between gases and solids; the interchange of heat and material by convection of gases flowing through granulates of definite grouping and properties; the penetration of reduction zones into the bulk of ores; heat losses of metallurgical equipment to its environment, and others.

This is an intensely interesting, readable monograph for students and
(Continued)

RECENT BOOKS RECEIVED

Adsorption and Chromatography. By H. G. Cassidy. Interscience. \$7.

Artificial Fibers. By R. W. Moncrief. Wiley. \$4.50.

The Behavior of Engineering Metals. By H. W. Gillett. Wiley. \$6.50.

The Chemistry of Hydrazine. By L. F. Audrieth & B. A. Ogg. Wiley. \$5.

Distillation. By A. & E. Rose et al. Interscience. \$14.

Flow Measurement With Orifice Meters. By R. F. Stearns, R. M. Jackson, R. R. Johnson & C. A. Larson. Van Nostrand. \$7.50.

An Introduction to Textile Finishing. By J. T. Marsh. Wiley. \$5.50.

Mechanical Engineer's Handbook. 5th ed. Ed. by L. S. Marks. McGraw-Hill. \$15.

The Phase Rule and Heterogeneous Equilibrium. By J. E. Ricci. Van Nostrand. \$12.

Plant Layout. By R. W. Mallick & A. T. Gaudreau. Wiley. \$7.50.

Progress in Chromatography. By L. Zechmeister. Wiley. \$8.

Soybeans and Soybean Products. Vol. II. By K. S. Markley. Interscience. \$11.

Synthetic Detergents. By J. W. McCutcheon. MacNair-Dorland.

Water Treatment. By E. Nordell. Reinhold. \$10.



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process man. A preview of it was published in *Iron & Coal Trades Review* (London), issues of May 27 and June 3, 1949.

11-Year Span

ELEMENTS OF FRACTIONAL DISTILLATION. Fourth edition. By Clark Shove Robinson and Edwin Richard Gilliland. McGraw-Hill Book Co., New York. 492 pages. \$7.

Reviewed by L. H. Allen, Jr., Robert A. Sandler and Robert O. Wolff

This latest edition of the well-known text book "Elements of Fractional Distillation," by Robinson and Gilliland, represents a complete revision of previous editions. Expanded in size, almost completely rewritten, and now a member of McGraw-Hill's Chemical Engineering Series, its format has been materially changed to place emphasis on the practical use of modern theory in the solution of problems involving distillation.

In general, the essence of the previous editions has been extracted, condensed, and brought up to date in the new edition. Subjects which warranted chapter status in the third edition are

now covered concisely, but adequately, in one or two paragraphs, or are used as illustrative examples. Despite this condensation of previous material, however, the inclusion of new data and information which has not received appreciable treatment in the past, serves to make this edition nearly twice the size of its predecessors.

Of particular interest in this new edition are the excellent chapters on vapor equilibria, which cover fully 100 pages, and the chapter on mechanical design of the fractionating column, which should prove of considerable value to the design engineer. The incorporation of nomenclature tables and references at the end of each chapter is another major improvement. Considerable use is made of illustrative problems in order to clarify the descriptive material and throughout the book major emphasis is placed on the use of enthalpy balances and the thermodynamic approach in general.

Other subjects which now receive extensive treatment—extractive and azeotropic distillation, alternate design methods for multi-component mixtures, batch distillation, simultaneous rectification and chemical reaction, and vacuum distillation—are an indication of the tremendous developments that have occurred in the span of 11 years since the previous edition.

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RECENT BOOKS & PAMPHLETS

Fats and Oils. "Animal and Vegetable Fats and Oils, 1945-1949." Complete statistical data on production, consumption and factory uses. Grátis. Facts for Industry M17-1-09, Bureau of the Census, Washington, D. C.

Water. "Quality of Surface Waters of the United States, 1946." Sixth in the series of annual reports. Gives almost 4,500 chemical analyses made by the Geological Survey during the water year ended Sept. 30, 1946. About 3,000 of this number are series of comprehensive analyses of composites of daily samples collected at 86 river stations. \$1.25. U. S. Geological Survey, Water-Supply Paper 1050, Superintendent of Documents, Washington 25, D. C.

Unit Processes. What's new in organic syntheses. Some highlights of recent advances in theory and practice. New perspectives and predictions. Flow diagram accompanies section on each process. Reprinted from March 1951, *Chemical Engineering*, 13 pages. 75 cents. *Chemical Engineering*, Editorial Dept., 330 West 42nd St., New York 18, N. Y.

Coal. "Preparation Characteristics of Some Coals Available for the Synthetic Liquid Fuels Industry." By Thomas Fraser, W. L. Crents and O. T. Barrett. 50 cents. Bureau of Mines Bulletin 495, Superintendent of Documents, Washington 25, D. C.

Synthetic Liquid Fuels. Annual Report of the Secretary of the Interior to Congress for 1950. Part I—"Oil from Coal." RI 4770. Part II—"Oil from Oil Shale." RI 4771. Part III—"Liquid Fuels from Agricultural Residues." RI 4772. Part IV—"Oil from Secondary Recovery and Refining." RI 4773. Grátis. Bureau of Mines, Washington, D. C.

Ladders. "Facts and Fancies About Ladders." Factors relating to the safe use of wood ladders, particularly limitations on methods of use related to the strength of wood and the basis for design. Painting of ladders, proof-testing under load and storage and maintenance are discussed. By L. J. Markwardt and A. D. Frase. Grátis. Forest Products Laboratory, Madison 5, Wis.

Potash. "The Potash Industry." Recent developments in the economics of the industry with particular reference to Carlsbad, N. M. By Louis H. Kurrelmeier. 82 pages. \$1.50. Division of Research, Department of Government, University of New Mexico, Albuquerque, N. M.

Fuel Oil. "Fuel Oil Requirements of Oregon and Southern Washington." Fuel oil consumption in the lower Columbia River region. Breakdown as to amounts of oil of each type used in various commercial categories. Author's conclusion: region must at once encourage fuel supply sources other than offshore tanker supplies for maximum safety and future industrial growth. By Chester K. Sterret. 20 pages. Grátis. Oregon State Engineering Experiment Sta., Corvallis, Ore.

Serpentine. "Utilization of Texas Serpentine." Four parts: Serpentine Deposits; Minerals, Composition, and Structure; Experimental Data; Possible Industrial Uses. Suggested for use in producing magnesium chloride and magnesia and ultimately magnesium metal. 52 pages. Grátis. Bureau of Economic Geology, University of Texas, Austin 12, Tex.

Nuclear Science Abstracts. Cumulative Index, Vols. 1, 2, 3 and 4, 1950. 243 pages. 60 cents. Technical Information Service U. S. Atomic Energy Commission, Oak Ridge, Tenn.

Vacuum. A quarterly review of developments in vacuum research and engineering. To contain articles by specialists in all parts of the world and extensively classified abstracts specially printed for detached filing. Subscription: £1 10 s. 0 d. W. Edwards & Co. (London) Ltd., Worcester Bridge Rd., Lower Sydenham, London, S. E. 26, England.

Safety. "Tank Talk." To appeal to and stimulate safety among the men who enter and clean gasoline storage tanks. Cartoon treatment amplified by jingles. Pocket sized. 52 pages. Grátis. Petroleum Chemical Division, Du Pont Co., Wilmington, Del.

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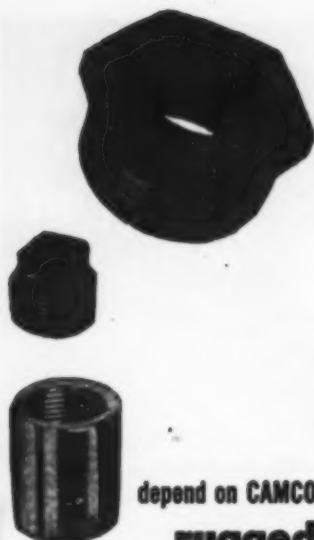
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Humidity Control 254B	"The Humidity Engineer"—Vol. 1, No. 1, of a periodical to be published by this company to present current technical and operating information on its Kathabar humidity control equipment. This number includes an article on blast humidity as a factor in cupola operation and one on a new continuous drying tunnel. 4 pages.	Surface Combustion Corp.
Waxes 254C	Collection of data sheets on various waxes several of which may be used to replace more expensive carnauba and Japan waxes. For each type: specifications, uses, packaging, price. Also data sheets on emery and 18 pages.	Concord Chemical Co.
Equipment 254D	For agitating and mixing equipment, kneading and blending units, grinding and classifying equipment; photographs, specifications charts, operating principles, uses. Drawings show synthesizing and processing systems. 36 pages.	Patterson Foundry & Machine Co.
Steam Traps 254E	Specifications on steam traps, float traps, air release valves and pipe strainers. How to calculate condensation loads and select traps for all classes of equipment including unit heaters, jacketed kettles, autoclaves. Pointers on installation and servicing. Installation photographs; sketches and diagrams showing typical trap arrangements, constructions and operations. 36 pages.	V. D. Anderson Co.
Lime Hydrators 254F	Construction details, dimensions and capacities of a line combining feature of Schulz, McGinn and Kusta hydrators. Photographs show equipment and schematic drawings show arrangements of hydrating plant and hydrator installation. 8 pages.	Hardings Co.
Steel Casting 254G	Techniques of centrifugal casting in permanent molds for production of cylindrical shapes in a variety of alloy steels. Reference tables list experience-proven alloy compositions. Drawings, charts, product photographs; sections on process, properties, design factors, applications.	Lebanon Steel Foundry
Magnetic Separator 254H	Unit consists of two magnetic separators in an enclosed rectangular sheet or cast metal housing. To remove tramp iron from materials conveyed in pneumatic, gravity flow or liquid lines. Construction, application and selection data; engineering diagrams. 4 pages.	Eries Mfg. Co.
Instruments 254I	Compares the principles of operation of Micromax and Speedmax speed recorders pointing out the advantages of the latter where unusual requirements must be met. Photographs show construction and installations; sketches show mounting dimensions. Also covers a line of tachometers. 20 pages.	Leeds & Northrup Co.
Resin 254J	Use of a powdered resin containing 70 percent chlorine in alkyl enamel systems. Outlines, mostly in tabular form, specific properties that may be obtained by properly formulating enamel systems; methods of formulation and manufacture; factors affecting quality. 17 pages.	Diamond Alkali Co.
Printing Calculators 254K	Two illustrated bulletins on printing calculators that multiply directly, divide automatically, add and subtract, and print the proof on the tape. Portable, completely electric in operation. 12 pages each.	Remington Rand Inc.
Ion Exchange 254L	Use of an amine-type, high-capacity anion exchange resin to remove sulphides from industrial and domestic water supplies. Adaptable to existing water softening equipment. Operating procedure, regeneration, capacity, simultaneous softening and sulphide removal, examples. 8 pages.	Rohm & Haas Co.
Insulation	Manual on 85 percent magnesia insulation. Properties, determination of correct insulation thicknesses, application and finishing procedures and maintenance. Photographs and line drawings. 86 pages. Only one copy available to an individual; requests must be made on business letterhead.	Magnesia Insulation Mfrs. Assn., 1317 F St., N.W., Washington 4, D.C.
Instruments 254M	Multi-record strip chart electric control potentiometers. Photographs, dimension drawing, control form tables. 4 pages.	Minneapolis-Honeywell Regulator Co.
Plating Agent 254N	Applications of a microscopically-derived silica aerogel for flat and semi-gloss varnish. Blending principles, additive screening test, typical grinding and reducing procedure for oleoresinous and alkyl flat coatings. 14 pages.	Monsanto Chemical Co.
Fire Brick 254P	Insulating fire brick for sustained use at 3000 deg. F. Industrial applications, refractory properties, physical and thermal characteristics in table form. Series of drawings shows use of brick in construction of slot type forging furnaces. 4 pages.	John-Manville
Plastics 254Q	Four sections on: vulcanized fiber; phenol fiber and special laminates; design and machining hints; this manufacturer's engineering and research facilities. Engineering data is presented in tabular form. 62 pages.	Taylor Fiber Co.

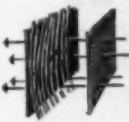
SUBJECT	FEATURES	COMPANY
Steel Pipe 255A	Black and galvanized pipe in all standard sizes from 1/4 to 4 in. Tables of dimensions, weights, test pressure, bending data, bundling schedules. Picture story of the steps of manufacture from strip through the heating furnace, the continuous welding process, and numerous finishing operations. 30 pages.	National Supply Co.
Conveyor Chains 255B	Chain-on-flat and chain-on-edge floor conveyors with a variety of pusher dogs used in connection with them. Also typical drive and take-up ends, sprocket and roller turns, cross sections, curves, inclines and declines which are used in these conveyor systems. Photographs, standard outline drawings, perspective drawings. Also shown are other types of floor conveyors such as slat, apron, scraper, roller flight. 90 pages.	Jervis B. Webb Co.
Oils 255C	Covers 170 different materials: linseed, soybean and fish oils, fatty acids, specialty products, hydrogenated alcohols, glycerides, sperm oils, lecithin. Detailed specifications and suggested uses. Temperature conversion table, oils conversion chart, relative viscosity values, bulking values for common pigments. Data on thinners, solvents, plasticizers, driers and soaps. 24 pages.	Archer-Daniels-Midland Co.
Refinery Products 255D	Engineering data on a line of oil, gasoline, liquefied petroleum gas, water, steam and air hose used in refinery operations. Data on various types of packing materials and expansion joints.	United States Rubber Co.
Chemicals 255E	Organic complexing agents for exacting chemical control of cations in solutions. Four sections on: 1) general information such as reactions, performance data and specifications; 2) applications such as detergent formulations, equipment cleaning, in soap, rubber and textile processing; 3) analytical uses; 4) toxicity. 124 pages.	Berzworth Chemical Co.
Materials Handling 255F	Standard specifications for a line of fork lift trucks, tractors and electric pallet truck. Photographs of various models. 4 pages.	Towmotor Corp.
Production Control 255G	Record-keeping management. Punched card methods are shown for every phase of production control including: engineering records and procedures, production and forecasting, materials controls subsetting and program reports. Also covered is how to schedule definite orders for regular as well as new production without delay or disorganization, processing production orders according to schedule, accurate delivery dates based upon current information on raw materials and machine facilities. 46 pages.	Remington Rand Inc.
Cellular Rubber 255H	Properties and test data. Graphs illustrate discussions on compression, influence of heat and aging. Discusses insulation value (heat and sound), resistance to oils and chemicals, toxicity, cementing, special purpose stocks. 20 pages.	Sponge Rubber Products Co.
Instruments 255I	Pictured and briefly described are types of apparatus to measure viscosity, constant temperature baths, film thickness, film applicators, drying times, viscosity, hardness and adhesion, appearance and color. Primarily for the paint industry. 22 pages. Another bulletin pictures and describes the principles of operation of a gage for dry thickness of non-electrical conductive coatings and other sheet-like materials. For use on aluminum and other nonferrous metals. 6 pages.	Gardner Laboratory
Oil Burners 255J	Units include automatic horizontal rotary type, steam turbine driven type, combination gas-oil type, semi-automatic type, pressure atomizing type. Selector chart, listing of specifications and capacities. Operation and control of each unit is described. 16 pages.	Ray Oil Burner Co.
Loading Docks 255K	Adjustable loading docks. Design and construction. Photographs of typical installations. 4 pages.	Rowe Methods, Inc.
Fittings and Flanges 255L	Data card. One side covers welding fitting: wall thickness and essential dimensions for all types for every nominal pipe size from 1/4 through 30 in. The other side covers forged steel flanges: dimensions, bolting data, for all types and weights for nominal pipe sizes from 1/4 through 24 in.	Taylor Forge & Pipe Works
Couplings 255M	Roller chain flexible shaft couplings. Engineering information for proper application includes dimensions, weights, service factors and horsepower ratings. 4 pages.	Link-Belt Co.
Instruments 255N	Spectrographic source unit containing the three basic circuits (AC arc, DC arc and high voltage spark) which permits the selection of conditions which are best suited to specific types of analytical work. The equipment and each circuit are illustrated and described. 4 pages.	Baird Associates, Inc.
Couplings 255P	Piloted steel couplings which can carry the weight of extended shafts with no intermediate bearing support. Large construction photograph, dimension charts and diagrams, close-up drawings showing parts. 6 pages.	Falk Corp.
Safety 255Q	Lists eye-hazardous occupations and eye protection for specific industrial hazards. Summarizes recommendations made by the Safety Engineering Service Bureau.	American Optical Co.
Valve 255R	Cushioned, single acting, non-return valves. Three different yoke assemblies on the elbow, angle and globe bodies are featured in detailed drawings with a complete list of parts. Testing, construction, installation, sequence of operation, servicing and specifications. 8 pages.	Golden-Anderson Valve Specialty Co.
Refrigeration 255S	Three flyers on this company's Freon-12 refrigeration units.	Worthington Pump & Machinery Corp.
Filters 255T	Pipe line filters for air and other gases. Illustrates and gives applications and specifications for 75 filters, including pressure and vacuum types. Describes operating principle which provides both mechanical separation and filtration. 8 pages.	Dollinger Corp.

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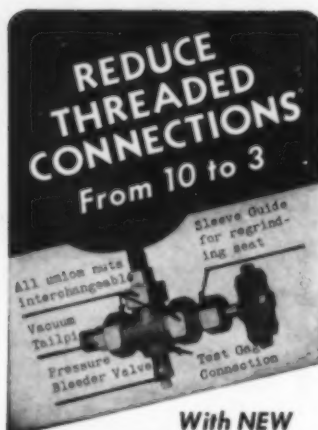


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SUBJECT	FEATURES	COMPANY
Chemical 254A	Typical reactions of dihydroxy diphenyl sulphone. Data on two forms of mixed isomers available in commercial quantities and two purified isomers available in experimental amounts. Suggested uses for the sulphone or its reaction products. 8 pages.	Monanto Chemical Co.
Equipment 254B	Two bulletins. One on cooling towers picture size and types to meet various requirements. Drawings and diagrams show design and construction features. 22 pages. The other on air cooled units shows installations for jacket water, gas, steam and hydrocarbon vapor cooling. 8 pages.	Hudson Engineering Corp.
Water Filters 254C	Self-cleaning filters. This company's model SC, use diatomaceous earth as a filter aid. Illustrations show construction, typical installations, arrangements of necessary piping. 6 pages.	Sparkler Mfg. Co.
Equipment 254D	Photographs and brief descriptions of the equipment engineered and manufactured by this company including gas absorbers, emulsifiers, dispersers, thickeners, scraper agitators, rotary dryers. 4 pages.	Cleveland Mixer Co.
Fintubes 254E	Describes construction of integral extended surface fintubes; lists range of sizes and materials in which they are available; illustrates heating and cooling applications. Engineering data includes design curves and a tabulation showing the comparative outside surface areas provided by different sizes of bare pipe or tubing and longitudinally finned pipe or tubing. 4 pages.	Brown Fintube Co.
Valves 254F	A steam valve sizing chart covering the range from 1 to 1 million pounds per hour and a butterfly valve sizing chart covering the range of 15 to 10,000 gal. per min. 2 pages each.	Fisher & Porter Co.
Crushers 254G	Construction features, design, capacity, specifications for a line of laboratory crushers. Available in mill and portable units. Lists typical installations, special types for handling various materials. 4 pages.	American Pulveriser Co.
Chemicals 254H	Reactions of diethyl acetylacetonate, a beta-keto ester, now available in research quantities. Useful in synthesis of such organic compounds as acids and ketones. 12 pages.	Monanto Chemical Co.
Mixers 254I	Two bulletins. One on fixed mounting mixers, top and side entering. Construction photographs labeled in detail, dimensions and specifications charts and drawings, installation views. 16 pages. Another on portable mixers—heavy duty industrial models. 12 pages.	Eastern Industries Inc.
Motor Drives 254J	Motor drives for all types of large air compressors. Tables, charts and graphs for matching motor characteristics to compressor requirements. Cross-sectional drawings; 2-page operational drawing. 34 pages.	Electric Machinery Mfg. Co.
Instruments 254K	Two bulletins. One covers a device for automatic control of industrial process streams and rates by measurement of their refractive indexes. Method of measurement and operation (schematic diagrams); design features (cross-sectional drawing). 4 pages. The other bulletin contains operation curves, diagrams and photographic illustrations of an amplifier system especially adaptable to the detection and correction of error signals and operation of null-balance systems. 4 pages.	Minneapolis-Honeywell Regulator Co.
Presses 254L	Standard and custom-built steam platen presses. Specifications for standard models ranging from 100 to 15,000 tons capacity. Illustrations show various types; both construction and installation views. 20 pages.	Baldwin-Lima-Hamilton Corp.
Stainless Tubing 254M	Outlines physical and mechanical characteristics of three annealing straight chromium stainless tubing steels: AISI types 405, 430, and 444. Data on analysis, creep strength, properties at room and elevated temperature, corrosion and oxidation resistance. 4 pages.	Babcock & Wilcox Tube Co.
Lift Truck 254N	Specifications and illustrations of a 2,000 lb. capacity lift truck designed to move materials through low clearance doors and truck van bodies yet tier 3 pallets high without changing loads from one lift truck to another. 2 pages.	Mobilift Corp.
Circuit Breaker 254P	Plug-in type circuit breaker for 15 to 50 amp. services featuring quick-make, quick-break operation and thermal-magnetic protection.	Trambull Electric Mfg. Co.
Plastics 254Q	Grades and types of laminated plastics made from phenolic varnishes, ranging from sheet stock to plywood crossbanding. How they are produced, case histories of their use in industrial service. Test data on their physical, chemical and electrical properties. Methods used in their fabrication and finishing. 43 pages.	Bakelite Co.
Metals 254R	Basic problems of metal soundness, porosity, welding, graphitization, creep strength, new alloys, code conformances. Two bulletins. One on cast steels. 52 pages. One on copper base alloys. 16 pages.	Lunkenheimer Co.
Graphite 254S	How colloidal graphite dispersions are used in the metal-working, glass, rubber and corrugated cardboard industries. 4 pages.	Acheson Colloids Corp.
Valve 254T	Cardboard working model demonstrates the principle of a venturi-ball valve. By moving the cardboard stem of the model down from the wide open position, the ball cage and ball move downward ending with the ball guiding horizontally into the seat.	Paul Valve Corp.
Crushers 254U	Rotary crushers. Cutaway photographs show construction and parts. Lists materials which equipment is best suited to handle. Specifications. 4 pages. Another bulletin on jaw crushers contains a photograph and brief description of eight different types and sizes. 4 pages.	Sturtevant Mill Co.

—End

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Industrial Oils

Durable Water Repellents from Fatty Amides

"Armide" is the Armour trade-name given to the general class of long chain fatty amides derived from fatty acids. These high molecular weight amides are high-melting, wax-like materials. The commercially pure amides are water-insoluble and neutral.

One amide in this series, Armide HT, has superior properties for water repellency applications when compared with paraffin and natural waxes.

The excellent water repellent properties of Armide HT derivatives are due primarily to the combination of the amide grouping with a long, saturated straight chain. Durability of the water repellent effect results from the relative insolubility of the derivatives under dry-cleaning operating conditions, and from their high-melting points and poor emulsification characteristics with the soaps and detergents used in laundering.

Armide HT is composed of 25% hexadecane amide, 70% octadecane amide and 5% octadecene amide, is off-white in color and has a melting point of approximately 98° C.

In contrast with the chemical inertness of the hydrocarbons, Armide HT is reactive chemically. Advantage has been taken of its reactivity with formaldehyde in particular to prepare thermally unstable quaternary ammonium salts. These are applied to fabrics from aqueous solution and decomposed under heat to leave an insoluble, durable water repellent



residue within the fabric. Reactivity with formaldehyde also permits compounding of stearamide or its derivatives with thermosetting resins to produce durable water repellent effects. Many of these thermally unstable compounds, however, are covered by patents and those patents should be consulted.

Armide HT is packaged in flake form in 100 lb. multi-wall paper bags. For samples or additional information on the Armides, mail the coupon below.

Low-Temperature Solvent Crystallized Oleic Acid

Another new product has been added to Armour's line of fatty acids. Already the manufacturer of the most complete line of high-purity distilled fatty acids that can be found anywhere, the Armour Chemical Division now offers low-temperature solvent crystallized oleic acid.

This exclusive process offers users of oleic acid a product that has advantages not found in ordinary distilled or pressed products. The extremely low temperatures employed guarantee a substantially lower saturated acid content than conventional types of oleic acid. In addition, solvent crystallized oleic acids are ester-free materials since the solvent used is not reactive with fatty acids. This new product is characterized by bland odor and has excellent heat stability.

Armour's low-titer White Oleic Acid meets U. S. Pharmacopeia specifications and is recommended for those uses that require a light color as well as a low titer. For applications that require a low-titer but not a very light color, low-titer Distilled Red Oil is recommended.

White Oleic Acid (Low Titer)

	Min.	Max.
Titer	—	5°C
Iodine No. (Wijs)	90	95
Acid Value	195	201
Saponification Value	195	201
Unsaponifiable	—	2%
Color (Lovibond 5 1/4" tubes)	—	1.5R-15Y

Distilled Red Oil (Low Titer)

	Min.	Max.
Titer	—	5°C
Iodine No. (Wijs)	90	95
Acid Value	193	200
Saponification Value	193	200
Unsaponifiable	—	3%
Color (Lovibond 1 1/4" tubes)	—	8.0R-30Y

Armour's Oleic Acids are available in 55 gallon drums and aluminum tank cars. Write today for samples and prices.

Lard Oil Lubricants

Lard oil possesses the property of "oiliness" so essential in the lubrication field. In addition, lard oils are readily saponified when treated with alkalis and possess non-drying qualities.

Where a high grade lubricant is required, as in drawing copper and brass tubing, Extra Winter Strained Lard Oil is recommended. Its low free fatty acid content makes it ideally suited as a base for such products.

Extra Winter Strained Lard Oil is only one in a complete range of lard oils offered to the lubrication field by the Armour Chemical Division. Write today for your free copy of a chart showing "Specifications for Armour Industrial Oils."

Reading for Research Chemists

To help research chemists, the Armour Chemical Division continually prepares informative literature on chemicals derived from fats. The two technical bulletins described below are available free of charge.

For research chemists interested in fatty amines (organic bases or alkalies made from fatty acids), Armour has prepared a detailed 24-page bulletin entitled, "The Chemistry of Fatty Amines."

"The Chemistry of Fatty Acids" is the title of another technical bulletin offered by the Armour Chemical Division. It describes fatty acids, their composition, reactions, and derivatives.

Either or both of these booklets are yours for the asking. Use the coupon below to make your request.

Mail this Coupon

Please send additional information on

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•

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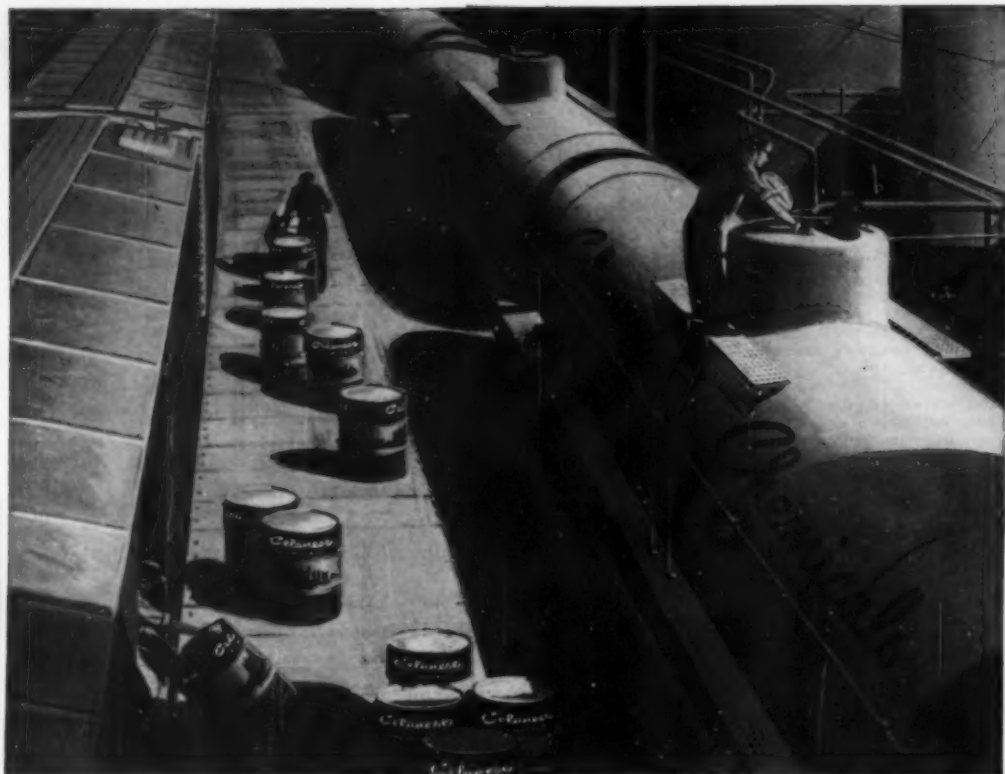
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Celanese chemical service includes expanded plant facilities employing the most recent developments in chemical production . . . a reliable source of raw materials virtually on the plant's doorstep . . . a nation-wide distribution system . . . research laboratories and pilot plants . . . and valuable technical

assistance based on a generation of experience in petroleum chemistry—assurance to industry of large-scale uninterrupted production.

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METHYLAL • n-PROPANOL • TRICRESYL PHOSPHATE • BUTYL ALCOHOLS • PROPYLENE OXIDE • DI-PROPYLENE GLYCOL

CAPITAL EXPENDITURES			INCREASE
	1950	1951	1950-1951
Index of physical capacity	293	325	+11%
Spent for expansion, modernization, millions	\$1,350	\$2,140	+59%
For expansion	74%	80%	+ 6%
For modernization and replacement	26%	20%	- 6%
Money to come from: depreciation & profits		91%	
Sale of stock		3%	
Other		6%	

Chemical Growth—1951 Model

Chemical firms are planning a record breaking expansion of productive capacity this year. In 1951—if chemical manufacturers carry through their expansion hopes—they will increase their new construction expenditures 143 percent compared with 1950. Total manufacturing expenditures will be up 79 percent for the same period.

Physical capacities in the chemical industry will be raised about 11 percent above the 1950 level this year according to industry plans. For all manufacturing the corresponding figure is 9 percent.

These are the highlights of McGraw-Hill's fourth annual survey of business' plans for new plants and equipment. These surveys provide the first direct measures of growth of industrial facilities.

To carry through their 1951 program, manufacturing industries would like to spend \$13.3 billion. That is 66 percent more than they actually invested in new plants and equipment in 1950 and by far the largest expenditure ever planned for one year.

All industry—railroads, utilities, other transportation and communications and mining, as well as manufacturing—plans to invest a grand total of \$21.5 billion in 1951. This is 45 percent more than was actually invested in 1950.

Not a Forecast—This is not a forecast of what 1951 capital investment will actually be. The \$21.5 billion total represents industry's plans to invest in new plants and equipment, as reported to the McGraw-Hill Department of Economics in January. The companies surveyed generally are the larger ones in their industries. Three

earlier surveys have shown that plans of these companies reflect the trend of investment in all industry.

This year, however, the survey was taken against the background of inflation. Prices of capital goods are at least 10 percent higher than they were a year ago. Construction costs have gained about the same. In addition, the urgency of mobilization and the sudden, sharp increase in demands on industry has speeded up expansion plans. Many businesses are rushing to get programs underway which, under other circumstances, might have come along only in another few years. Plans for 1951 reflect this.

These plans may not be fully realized. As military production gains in volume, it will put increasing pressure on U.S. supplies of equipment, materials and manpower. Washington has not directly limited industrial investment yet. But it is to be expected that military demands will restrict output of some capital goods before 1951 is over.

For these reasons, McGraw-Hill's survey does not necessarily show how much will actually be spent on new plant and equipment this year. It does show what business wants to do—if the materials, equipment, and manpower are available.

Major findings—(1) Manufacturing industries plan to expand their facilities 9 percent in 1951. Greatest increases are planned for the industries preparing to meet the brunt of defense production demands. Among them are transportation equipment, auto and electrical machinery industries, chemicals, steel, and general machinery.

(2) The manufacturing industries have raised their capacity an average of 75 percent since 1939. The chemical industries have almost tripled their capacities. The general machinery industry has more than doubled its facilities in this period.

(3) Expenditures, as planned for 1951, total \$21.5 billion for all industry. Greatest single increase—almost quadrupling its 1950 rate of investment—is in transportation equipment, largely in the aircraft industry. Nonferrous metals show an increase of 175 percent over 1950, reflecting that industry's drive to meet mobilization needs for metal.

(4) Expansion gets top priority among claims on industry's investment dollar. Last year manufacturers spent only 43 cents of each investment dollar to enlarge their capacity. The largest share of the dollar, 57 cents, went to replace and modernize existing facilities. This year the figures are turned around—58 cents going for expansion.

(5) Industry plans to finance the great bulk of its new facilities—98 percent in manufacturing—from its own funds. And, as usual in postwar years, the biggest share of the money—91 percent for chemicals—will come from profits and reserves.

New Capacity—Outbreak of the war in Korea added new impetus to an upswing already well underway in industry's capital investment. When McGraw-Hill made its 1950 survey, industry planned to spend only \$12.4 billion.

Two interim surveys during 1950, showed that industry began to revise its plans upward in the spring and then raised them sharply after Korea. Actual investment during the year, as shown by this latest survey, was almost \$15 billion.

Industry's 1951 plans reflect the nation's needs for increased production to meet mobilization demands. Industry is expanding its facilities to meet both military needs and booming civilian demand. But the big emphasis is on mobilization requirements. The chemical industry has seen its products multiply, adding to the difficulties of measuring capacity.

To overcome these difficulties McGraw-Hill, in making its surveys, has asked all companies to use their own measures of physical capacity. A steel company may use ingot tons,

(Continued)

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ECONOMICS, cont. . .

How Industrial Capacities Have Grown

	Index of Physical Capacity (1929 = 100)				
	Jan. 1946	Dec. 1948	Dec. 1949	Dec. 1950	Planned 1951
Chemicals	172	250	264	283	325
Automos	164	130	140	153	179
Food	117	125	138	145	152
Petroleum refining	123	160	171	178	183
Machinery	154	200	216	236	260
Steel	112	115	121	126	139
Electrical machinery	175	280	301	325	371
Transportation equipment	243	256	265	288	327
Other manufacturing	109	120	126	132	142
All manufacturing	131	156	164	175	191

for example, while an aircraft engine maker compares the rated horsepower of the engines he produces. The results are the only available direct measures of the expansion in American industry since before World War II.

Emphasis on Expansion—The dramatic gains in capacity scored last year—and plans for even greater expansion this year—reflect a major shift in industry's use of capital funds. In most fields, expansion programs are now coming ahead of modernization programs.

A year ago, manufacturing industries planned to invest 65 percent of their funds in replacing and modernizing existing equipment. Korea reduced that figure to 57 percent. And, in the year ahead, industry's budget now indicate that only 42 percent of investment funds will go to replacement and modernization.

Shares vary by industry, of course. Chemical and transportation equipment companies plan to put 80 cents of their capital dollar into expansion. The textile industry, growing at a slower pace, will use only 24 cents of its dollar to expand facilities.

Even with the great increase in the share going for expansion, 1951 budgets for modernization and replacement will top 1950—because overall investment will be so much larger. This indicates that, if present plans are carried out, industry will make considerable headway in modernizing its facilities.

Where the Money Comes From—Industry's plans for financing its huge expansion program reveal a sharp contrast to World War II. Then, with business emerging from ten years of depression and with wide-spread doubts as to whether war-built plants could be used in peace, the government directly financed a big share of the new facilities.

Today industry plans to finance virtually all of its capital program itself. The United States Steel Corporation, for example, has announced that it will not need outside financing for new facilities. It has authorized

almost \$700 million for added facilities—and the program is likely to be larger. The McGraw-Hill survey shows that manufacturing industries as a whole expect to rely on government, or government-guaranteed, loans for only 2 percent of the funds to carry through their 1951 programs.

Government aid through accelerated amortization is counted on widely. Survey results on this are tentative, since many companies do not know how much of their programs will be granted approval. But manufacturing companies plan now to apply for certificates of necessity on something more than 40 percent of their programs.

The industries on which defense demands are greatest, such as chemicals, are asking for accelerated amortization on a much larger share of their programs.

Construction Plans Jump—The boom in industrial building which developed in 1950 promises to continue at a high level—according to McGraw-Hill's survey of business plans. In the manufacturing industries, at least, business plans to spend 79 percent more on construction in 1951 than in 1950. The rise here is slightly larger than the 66 percent rise indicated in total expenditures, suggesting that a larger share of the investment dollar will go into buildings.

Again, construction expenditures under today's plans will rise most sharply in the industries expanding most rapidly. The chemical industries plan to more than double their construction expenditures in 1951.

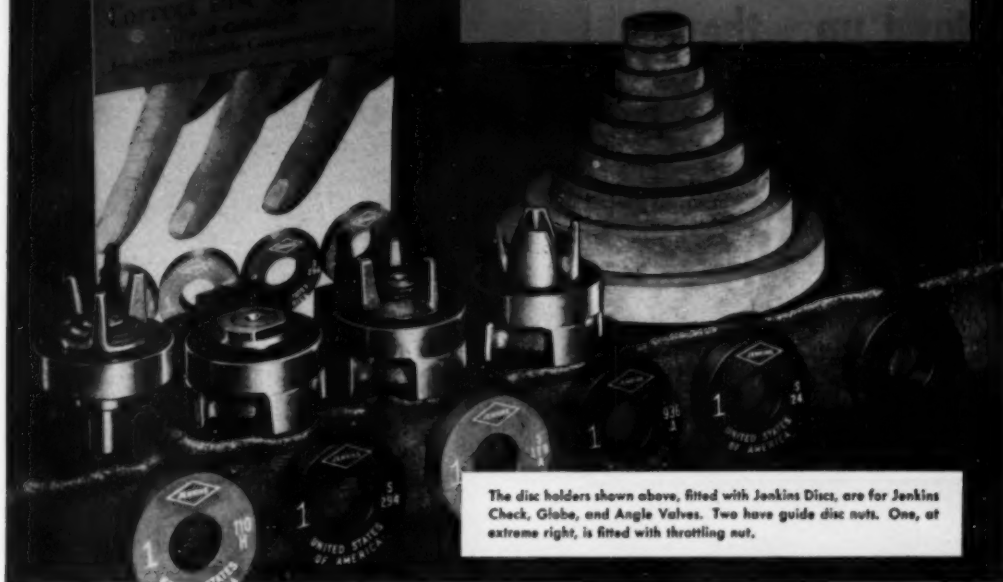
More to Come—Great as is the upswing in investment plans, businessmen expect defense needs will force still greater expenditures. The survey was taken in January, soon after the Chinese armies entered Korea and while the government was presenting its defense budget for fiscal 1952. At that time, more than half of the business leaders surveyed expected that additional defense orders would force them to raise their plans for new plants and equipment later in the year. —End

A GUIDE

FOR THE CORRECT DISC SELECTION
FOR CHECK, GLOBE, AND ANGLE VALVES



DELIVERING continuous Valve Efficiency



The disc holders shown above, fitted with Jenkins Discs, are for Jenkins Check, Globe, and Angle Valves. Two have guide disc nuts. One, at extreme right, is fitted with throttling nut.

Now, when continuous valve efficiency is vital . . . you can rely on readily available Jenkins Renewable Composition Discs to provide the valve protection that greatly extends service life. Proper disc selection and replacement in time guard against premature wear, can multiply the original efficiency of valves many times over.

Disc replacement is simple and easy, can be done without removing valves from the line. To save more time, maintenance-wise valve users keep on hand a stock of disc holders fitted with the discs most commonly used.

Money-saving idea for disc-valve maintenance

Keep on hand a stock of disc holders fitted with the discs most commonly used. This permits quick replacements, saves valuable time.



Slip off the disc holder with the old disc, and slip on another containing the new disc.



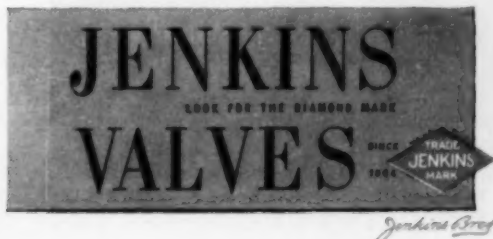
When you have time, reload the old disc holder with a new disc.

Only Jenkins makes both Valves and Discs

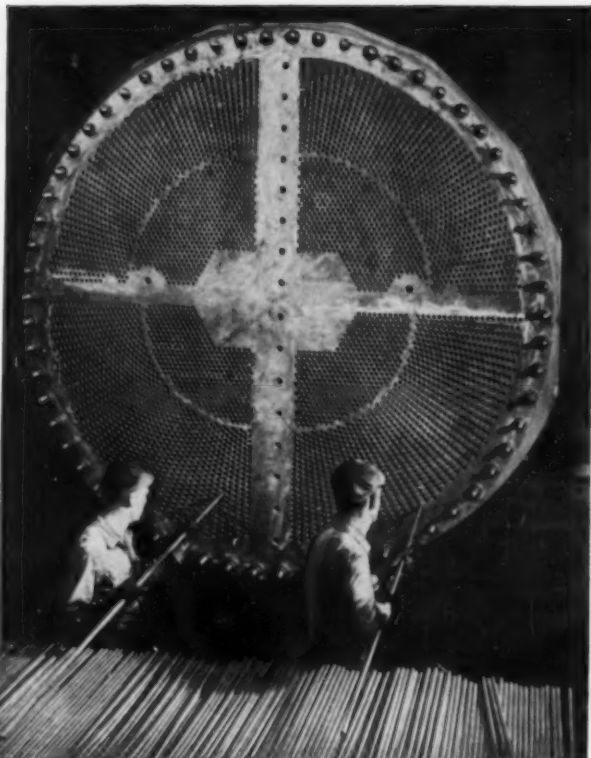
Originator of the first successful Renewable Composition Disc, Jenkins Bros. has continued to set quality standards. That's why you can rely on your Jenkins Distributor for discs of time-tested design and composition, plus authoritative disc information.

Ask your Jenkins Distributor for the folder, "A Guide to Correct Disc Selection" . . . also the "Jenkins Disc Selector", a handy wall chart listing recommended discs for all common services, temperatures, and pressures. Or write Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.

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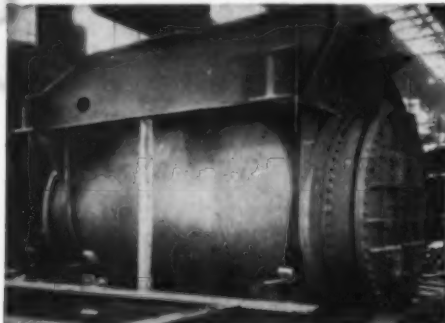
These tubes will
stand up...they're
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CUPRO-NICKEL



Installing Revere Cupro-Nickel Tubes in a condenser built by Westinghouse Electric Corp., Essington, Pa., for use in a 30,000-ton tanker built for Philadelphia Tankers, Inc., and to be operated by The Atlantic Refining Co. Three of these tankers were built by the New York Shipbuilding Corporation, Camden, N. J.



Rolling the ends of the tubes into the Revere Cupro-Nickel Tube Plates.



Exterior view of one of the tanker condensers. Both main and auxiliary condensers contain Revere Cupro-Nickel Tubes and Plates.

When Philadelphia Tankers, Inc., decided to order three new ships it was determined that they would embody the very best and newest ideas in tanker construction. The final designs included so many novel ideas and important advances that the chief engineer, Dr. Lester M. Goldsmith, was invited to read a paper describing them before the American Society of Mechanical Engineers. However the condenser tubes and tube plates on these ships are thoroughly conventional. These are Revere Cupro-Nickel, the preferred alloy not only for marine use, but in many shore installations where water conditions are difficult. These tubes really stand up.

Whether cupro-nickel should be used on shore depends on the nature of the problems encountered. In some instances another alloy, such as Admiralty, Muntz Metal, Naval Brass, Aluminum Brass may serve as well at less cost in condensers and heat exchangers. Revere will gladly collaborate with you in studying the economics of condenser tube selection as applied to individual installations, new or old.

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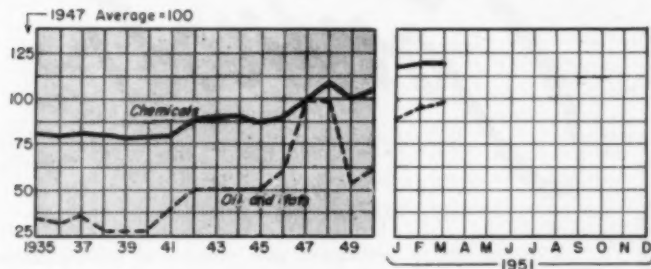
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Process Industry Trends

PRICES

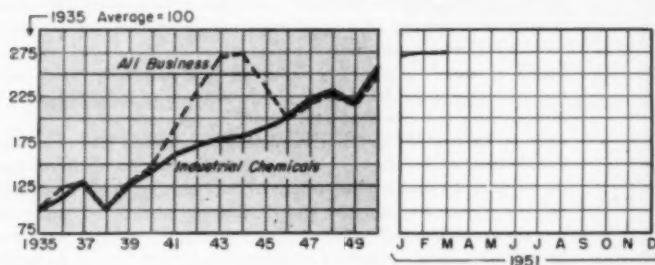


Chemical Engineering's Price Index

Chemicals—No change
Oils & Fats—Down 1.69

	Chemicals	Oils & Fats
As of April 1.....	118.98	96.90
Last month	118.98	98.69
April 1950	99.92	53.57
April 1949	102.03	61.28

CONSUMPTION

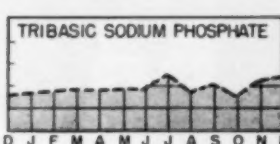
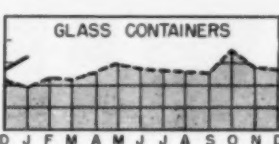
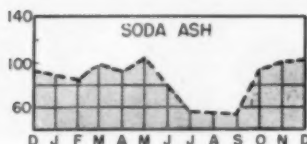
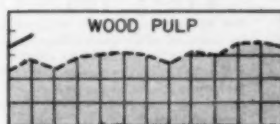
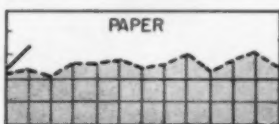
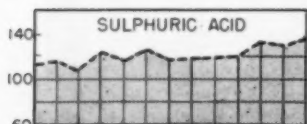
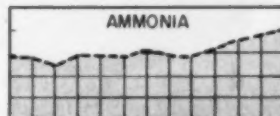
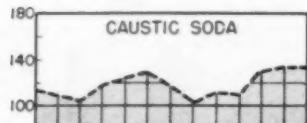
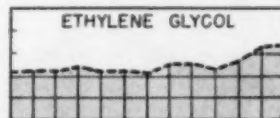
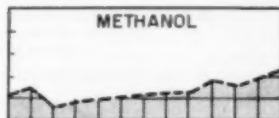
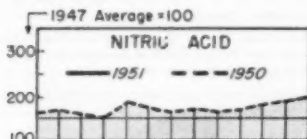


Industrial Chemicals Index

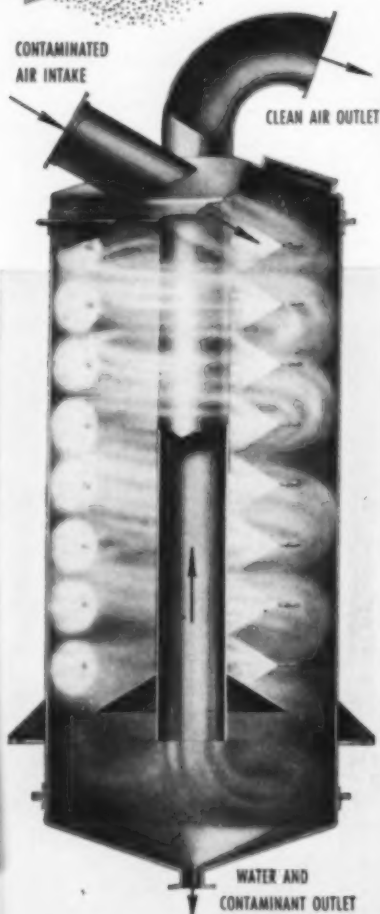
	December	January
Fertilizers	57.95	59.20
Pulp and paper	26.95	29.90
Petroleum refining ..	22.85	25.50
Iron and steel	15.38	16.40
Rayon	25.40	28.20
Glass	21.63	24.05
Paint and varnish ..	22.85	20.79
Textiles	11.96	13.72
Coal products	11.10	11.08
Leather	4.54	4.37
Explosives	8.20	7.65
Rubber	5.85	6.24
Plastics	18.40	17.50

INDEX 264.14 274.60

PRODUCTION



DUST and FUME Control



MAHON FOG-FILTER

This Mahon Fog-Filter is designed primarily for removal of air contaminants of less than 10 microns in size, and to provide industry with a less costly precipitator for mists, fumes, high temperature gases and other fractional micron air contaminants which would escape other types of collectors.

Special equipment engineered to solve individual problems posed by dusts of all kinds, fly ash, chemical fumes, gases of high or low temperature, aerosols, and other troublesome air pollutants.

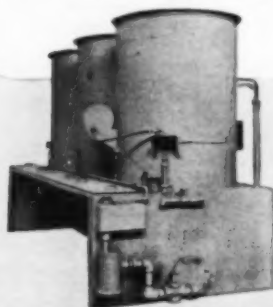
In dealing with air contaminants, each individual air cleaning problem must be approached with a view to determining what type of collector or filter is required to produce maximum results under existing conditions. Study and analysis of the character and extent of the pollutant is therefore imperative in arriving at a satisfactory solution. Mahon dust and fume control engineers have, over a period of years, developed and perfected special Wet and Dry Collectors and Fog-Filters which have proved highly successful in coping with all types of industrial air contaminants—a few are illustrated here . . . they are serving today in some of the most difficult and mandatory air cleaning jobs in industry. Each installation has been engineered to do the specific job. If you have an air pollution problem, regardless of its character, it will pay you to call in a Mahon engineer and let him show you what Mahon equipment has done with like pollutants under conditions comparable to your own. See Mahon's Insert in Sweet's Mechanical Industries File for further information, or write for Industrial Equipment Catalog A-650.

THE R. C. MAHON COMPANY

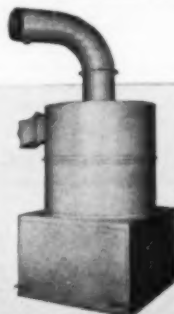
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Engineers and Manufacturers of Dust and Fume Control Equipment Including Cyclone Collectors, Hydro-Foam Collectors, Jet Trap Collectors, Hydro-Filter Collectors, and Fog-Filters and Cupola Stack Washers.

All Mahon Equipment is Erected by Mahon to Insure Complete Satisfaction.

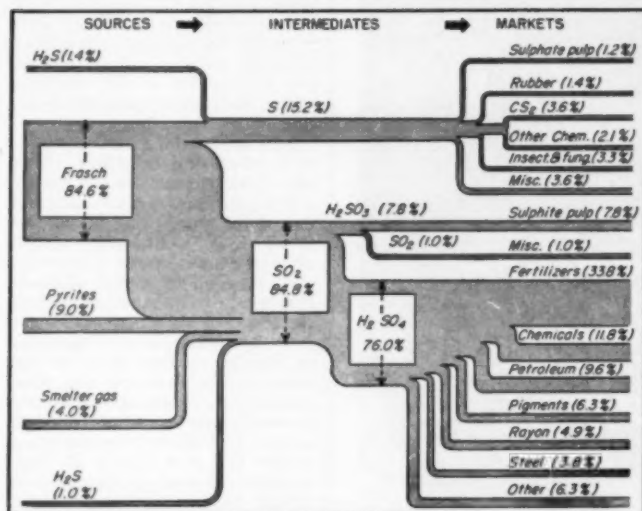


Mahon Hydro-Foam Dust Collector



Mahon Jet Trap Dust Collector

MAHON



How the available sulphur finds its way into our consuming industries.

Sulphur

Backbone of our chemical economy, it finds its way into every phase of our life.

Sulphur is the hidden building block of a large segment of our modern economy. Like tap water, we just expect to get all we want if we need it. But sulphur finally became a scarce material in 1950. Actually there is no shortage of sulphur sources. There is plenty of it available if customers are willing to pay a reasonable price to get it. The catch lies in the price we are willing to pay to bring additional sources of sulphur into production.

This country has depended on Frasch process mines for the bulk of its sulphur in recent years at a price of \$16-\$18 per long ton at the mine. In 1950 we produced about 5,200,000 long tons of elemental sulphur by this process. But even this huge amount was not enough to keep our stockpiles from dwindling at a rapid rate. Shipments from the mines reached 5,600,000 long tons.

What is the reason for this surprising situation? Basically the answer lies in the extremely rapid growth in sulphuric acid needs. In 1950 we made and used almost 12,700,000 net tons of 100 percent acid. Some of

this acid was made by fortifying "spent acid"—acid that has already been used in a process but which has not changed chemically—but the bulk of our acid consumption (12,100,000 tons) was new acid. This new acid is the big product eating up sulphur mined by the Frasch process. The rest comes from pyrites or byproduct sources such as smelter units, and hydrogen sulphide carrying gases.

In addition to the extremely large amount of sulphur used in acid production the Frasch-mined sulphur is exported in sizable quantities. In 1950 our exports were 1,087,000 long tons. NPA has cut this amount. In the first three months of this year the exports were held down to 200,000 long tons, or an annual rate of 800,000 long tons. We cannot completely eliminate sulphur exports without creating considerable disruption of industrial operations in western Europe where a very sizable sulphuric acid capacity has been built since the war. Much of this new capacity, especially in Great Britain is designed to use sulphur.

The fact remains that our above-ground brimstone reserves have fallen off sharply in the past few years. In 1935-39 period—when we were only producing 2,175,057 long tons per year—we had mine stocks of 3,560,-

000 long tons. In December of 1950 (latest month for which data are available) our producers' stocks had fallen to 2,654,530 long tons. A drop of 444,475 long tons in a 12 month period. Obviously we cannot afford to dissipate our vital sulphur stocks at this rate indefinitely. The steps taken by NPA to cut sulphur exports will help. The sulphur companies have already set up their own allocations based on a percent of 1950 contracts. This will assure major consumers of almost as much sulphur as they received in the peak years of the past.

However this will not lick the basic problem of a growing demand for sulphuric acid. Last year production of acid jumped up more than a million tons over the 1949 rates. Furthermore production topped our national rated acid capacity (which can be exceeded by pushing operating equipment) of 12 million tons per year. These production records have been the result of a phenomenal peacetime demand. War orders had relatively little effect on last year's output. In the last war about 2 million tons per year of sulphuric acid went into direct military uses. A sizable amount of acid will therefore be needed next year for direct military needs. Where will it come from? The recent export cutback will result in saving the equivalent of 1,000,000 short tons of new acid. It will go a long way in helping to solve the short term raw material shortage problem, but active consideration of other raw materials is the watchword among acid producers as 1951 gets under way. With current acid prices offering a very attractive market, more acid will undoubtedly be produced to satisfy the 1951 demand.

Large quantities of sulphur-bearing gases are formed in the smelting of metal sulphide ores. Since such gas is an expensive nuisance in the vicinity of the smelter and it can often be marketed as sulphuric acid, a substantial tonnage of sulphur is recovered as acid in this manner. About 190,000 tons of sulphur are recovered in this way annually. With higher acid prices it can be expected to become even larger.

Another very sizable potential source of sulphur that is receiving considerable attention is the sour natural gas that occurs in various oil fields. For example, in 1949, Stanolind Oil & Gas started operating a unit

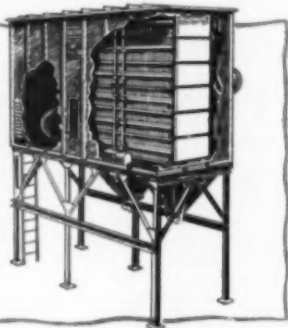
(Continued)



At the Kellogg Company of Battle Creek, Mich., this Pangborn Dust Control system salvages 35 tons of valuable dust per day. Collected from the corn mill and the Gro-Pup building, the dust is valued at \$40 a ton... building a profit of \$1400 a day for Kellogg!

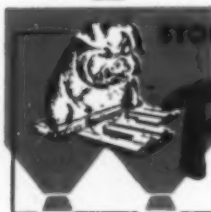
Here's how Pangborn makes Dust Control profitable for industry!

Pangborn Dust Collectors make low-cost dust control possible. As this cutaway shows, type "CH" Collectors are compact, offer maximum filtering area in a given size. Filter life is prolonged because dust-laden air passes through collector at low velocity. Efficiency is extremely high; in fact, clean exhausted air can often be returned direct to plant.



FIND OUT how Pangborn Dust Control turns dust into profits. Write for a copy of Bulletin 909A to: PANGBORN CORPORATION, 2600 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the latest developments in Dust Control and Blast Cleaning Equipment



STOP THE DUST HOG
from stealing profits with

Pangborn
DUST CONTROL

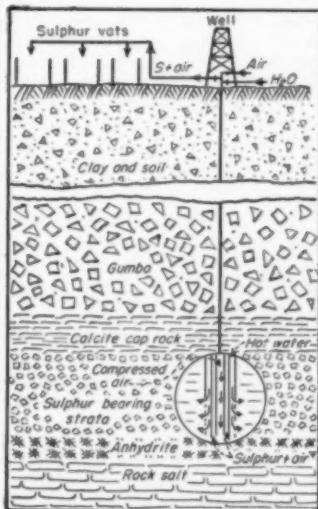
COMMODITY SURVEY, cont. . .

that recovers sulphur from sour natural gas. Last year Texas Gulf Sulphur placed a 425-ton-per-day sulphur recovery unit on stream at Worland, Wyo. Hancock Chemical Co. is removing sulphur from refinery gases in the Los Angeles area. The sulphur is used by a nearby acid plant. Freeport Sulphur Co. is also recovering sulphur from refinery gases near Westville, N. J.

Back in 1942 this source was tapped by Southern Acid & Sulphur (now a part of Mathieson Chemical Corp.). A flowsheet showing a schematic outline of the process used by them is shown (p. 267). In actual practice a series of converters and wash towers may be used. Fluor Corp.'s H₂S stripping process is also shown on the flowsheet.

A major source of acid raw material that has lost favor in recent years—due to the low cost and lower capitalization of brimstone-using contact acid plants—is pyrites. This material is imported in large quantities to the U.S. and Canada has large available resources which could be utilized by our acid producers but there is a catch. If a plant is not designed to utilize pyrites when it is built it might almost double the capital outlay for equipment in order to adapt it to pyrites burning operations.

This conversion cost has created considerable interest in converting pyrites to sulphur at the source of the pyrites. A Canadian firm has started building a plant which will produce sulphur from pyrites.



Frasch process filled past needs.

Where Our Sulphur Goes

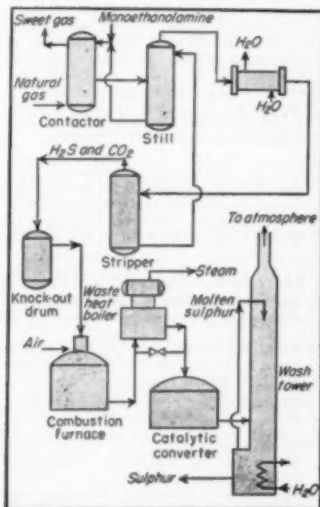
	(1,000 Long Tons of S)		
	1948	1949	1950
Chemicals	2,431	2,622	2,918
H ₂ SO ₄	170	160	200
CS ₂	18	16	20
SO ₂	82	69	105
Other chemicals	859	295	275
Sulphite pulp	89	89	60
Other wood pulp	75	60	75
Rubber	125	125	140
Insect & fung.	155	125	175
Other uses			
Total non-acid	1,025	900	1,150
TOTAL CONSUMED	3,656	3,522	4,066

Late last year the major Frasch-process sulphur producers raised their price to \$21.22 per long ton at the mines. This increase makes possible reconsideration of processes that were formerly non-economic.

In past years our large reserves of low-grade sulphur-bearing ores were not tapped for their sulphur content because of the cost angle. However, last month the Chemical Construction Co. announced a new process which will permit recovery of elemental sulphur from low-grade sulphur ores. A plant using this process is scheduled to be built in Wyoming. Chemical Construction is already building one in Colombia. (Chemical Engineering, March 1951, p. 128.)

Major Producers

Texas Gulf Sulphur Co.	Monroe Bluff, Tex.
	New Gulf, Tex.
	Spindletop Dome, Tex.
	Worland, Wyo.
Freeport Sulphur Co.	Hoskins Mound, Tex.
	Grand Esalle, La.
	Westville, N. J.
Deval Sulphur & Potash Co.	Orchard Dome, Tex.
Jefferson Lake Sulphur Co.	Chimney Dome, Tex.
	Long Point Dome, Tex.
Matheson Chemical Corp.	Macdonia, Ark.
	McKamie, Ark.
Hancock Chemical Co.	Long Beach, Calif.
Lion Oil Co.	El Dorado, Ark.
Standard Oil & Gas Co.	Elk Basin, Wyo.



H₂S is a growing source of sulphur.

CHEMICAL ENGINEERING—April 1951

Here's BIG NEWS

on Blast Cleaning Dust Control Precision Finishing

Blast Cleaning Unit is PORTABLE!



Ideal for maintenance and many other jobs, including removal of rust, dirt, scale, etc. Economically cleans large objects like tanks, bridges, structural work before painting. Six sizes, stationary or portable, from\$170.00 and up

Hydro-Finish SPEEDS POLISHING!

Removes scale, and directional grinding lines . . . prepares surfaces for plating and holds tolerances to .0001"! Liquid blast reduces costly hand cleaning and finishing of molds, dies, tools, etc. Models from \$1295.00 and up



STOP DUST at the SOURCE!



Pangborn industrial type Unit Dust Collectors trap dust at source. Machine wear is minimized, housekeeping and maintenance costs reduced. Solves many grinding and polishing nuisances and material losses. Models from \$286.00 and up

COMPACT Blast Cabinet for SMALL WORK!

Ideal for producing smooth, clean surfaces on pieces up to 60" x 36" in size. Cleans metal parts, removes rust, scale, grime, dirt, paint, etc., in a few seconds. Saves money all year 'round. Models from \$315.00 up



Look to Pangborn for the latest developments in Blast Cleaning and Dust Control Equipment

Pangborn

MAIL
COUPON
FOR DETAILS

- Check for more information
- ☐ Blast Cleaning Cabinets
 - ☐ Blast Cleaning Machines
 - ☐ Unit Dust Collectors
 - ☐ Hydro-Finish Cabinets

PANGBORN CORP., 2606 Pangborn Blvd., Hagerstown, Md.
Gentlemen: Please send me more information on the equipment I've checked at the left.

Name.....
Company.....
Address.....
City.....Zone.....State.....

New Construction

Proposed Work

Ill., Kankakee—Armour & Co., Pharmaceutical Div., U. S. Yards, Chicago, Ill., plans to construct a pharmaceutical plant. Estimated cost \$1,000,000

Ind., Clarksville—Colgate-Palmolive-Peet Co., Jeffersonville, plans to construct a 1, 2 and 3 story factory. Albert Kahn Associates, New Center Bldg., Detroit, Mich., Archt. Estimated cost \$125,000

Mich., Edmore—Carbonyl Co., Inc., 11177 East 8 Mile Rd., Detroit, plans to construct a carbide metal plant including facilities for processing tungsten carbide. Estimated cost \$2,000,000. Smith-Hinchman & Grylls, 800 Marquette Bldg., Detroit, Cons. Engrs.

N. J., Morris Township—Mennen Co., 345 Central Ave., Newark, plans to construct a plant on a 90 acre tract here for the manufacture of toilet preparations. Estimated cost \$2,500,000

S. C., North Charleston—Pure Oil Co., 35 East Wacker Dr., Chicago, Ill., plans to construct a storage plant here. Estimated cost \$500,000

Tex., Pampa—Phillips Chemical Co., Bartlesville, Okla., plans to construct a plant here to reclaim sulphur from sour gas. Estimated cost \$1,250,000.

Tex., Port Arthur—Gulf Oil Corp., Port Arthur, plans to construct an additional plant unit for the manufacture of iso-octyl alcohol. Estimated cost \$3,000,000

Tex., Port Arthur—Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa., plans to construct a chemical plant here. Estimated cost \$6,500,000

Tex., Port Neches—U. S. Rubber Co., Port Neches, plans additional expansion at its synthetic rubber plant. Estimated cost \$1,000,000

Wash., Irwin—Spokane Portland Cement Co., Old National Bank Bldg., Spokane, plans to enlarge its cement plant. Estimated cost \$3,500,000

Wis., Manitowoc—Manitowoc Portland Cement Co., Manitowoc, plans to construct an addition to its cement plant to include 340 ft., long kiln and 300 ft. concrete stack. Estimated cost \$2,000,500

Contracts Awarded

Ala., Childersburg—Besunit Mills, Inc., c/o Daniel Construction Co. of Alabama, Inc., 800 7th Ave., S. Birmingham, contractor, will construct a rayon yarn plant to be operated by North American Rayon Corp. Estimated cost will exceed \$5,000,000

Ala., McIntosh—Mathieson Alabama Chemical Corp., subsidiary of Mathieson Chemical Corp., 610 South Sharp St., Baltimore, Md., has awarded the contract for a plant for the manufacture of chlorine and caustic soda to Blaw-Knox Construction Co., Farmers Bank Bldg., Pittsburgh, Pa. Estimated cost \$10,000,000

	Current Projects		Cumulative 1951	
	Proposed Work	Contracts	Proposed Work	Contracts
New England.....				\$415,000
Middle Atlantic.....	\$2,900,000	\$26,000,000	\$2,900,000	25,721,000
South.....	400,000	40,186,000	18,300,000	173,223,000
Middle West.....	3,125,000	282,000	20,625,000	47,248,000
West of Mississippi.....	18,800,000	18,771,000	101,300,000	133,523,000
Far West.....	9,500,000		8,750,000	8,730,000
Canada.....			90,127,000	28,266,000
Total.....	\$33,425,000	\$82,338,000	\$308,602,000	\$427,126,000

Colo., Denver—Gates Rubber Co., 101 South Bway, has awarded the contract for a factory to Newton-Davis & Co., 2000 West 8th Ave. Estimated cost \$294,567

Fla., Bunnell—Lehigh Portland Cement Co., 718 Hamilton St., Allentown, Pa., has awarded the contract for a cement manufacturing plant between Bunnell and Flagler Beach, to Duval Engineering & Contracting Co., East Adams St., Jacksonville and Walsh Construction Co., 122 East 42nd St., New York, N. Y. Estimated cost \$11,000,000

Ga., Macon—Procter & Gamble Co., Ivorydale, Cincinnati, O., has awarded the contract for alterations to its plant here to Day & Zimmerman, Inc., Packard Bldg., Philadelphia, Pa. Estimated cost \$100,000

Ill., Chicago—Armstrong Paint & Varnish Co., 1414 South Kilbourn St., has awarded the contract for an addition to its plant to Campbell-Lowrie-Lauthermilch, 400 West Madison St., Chicago. Estimated cost \$82,000

Mo., Fagdale (St. Louis P. O.)—Reardon Co., 2208 North 2nd St., St. Louis, has awarded the contract for a paint manufacturing plant to Fruin-Colson Contracting Co., 1706 Olive St., St. Louis. Estimated cost \$725,000

Mo., Vandalia—Walsh Refractories Corp., 101 Ferry St., St. Louis, will improve and construct additions to its plant, including tunnel kiln, new press and additional grinding equipment. Work will be done by owners with separate contracts. Estimated cost \$460,000

N. J., Gibbstown—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., will enlarge its Repsuna plant here. Work will be done with own forces.

N. J., Grasselli—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., has awarded the contract for a warehouse to J. Emil Anderson & Son, 1809 Balmoral St., Chicago, Ill. Estimated cost \$1,000,000

Tenn., Memphis—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., will construct a plant for the manufacture of hydrogen peroxide, at Fite St. and Hy. 51. Work will be done with own forces

Tenn., Memphis—Kimberly-Clark Corp., N St., has awarded the contract for a mill building to Tri-State Construction Co., 3 Suten Bldg., Memphis. Estimated cost \$2,000,000

Tex., Dallas—Johnson & Johnson, 9000 Denton Dr., will construct a surgical dress-

ing plant. Work will be done by owners. Estimated cost \$225,000

Tex., Houston—Carpenter Paper Co., 315 East Lancaster St., Ft. Worth, has awarded the contract for a warehouse to A. H. Brodkey Construction Co., 2311 Douglas St., Omaha. Estimated cost \$275,000

Tex., Houston—Goodyear Synthetic Rubber Co., LaPorte Rd., has awarded the contract for expansions to its synthetic rubber plant here to Tellepsen Construction Co., 1710 Telephone Rd. Estimated cost \$420,000

Tex., Houston—Goodyear Synthetic Rubber Co., LaPorte Rd., will construct second phase of synthetic rubber manufacturing plant here. Work will be done by purchase and hire. Estimated cost \$375,000

Tex., Houston—Pittsburgh Plate Glass Co., 101 Crawford St., has awarded the contract for a shop building to W. S. Bellows Construction Co., 716 North Everton St. Estimated cost \$86,115

Tex., Port Isabel—Taylor Refining Corp. and Mayfair Minerals, Inc., Port Isabel, will improve and enlarge its refinery here. Work will be done by owners. Estimated cost \$475,000

Tex., Port Lavaca—Aluminum Co. of America, Port Lavaca, has awarded contracts to Al Johnson Construction Co., 608 Foshay Tower, Minneapolis 2, Minn., for Project 1, aluminum production pot line, including line, buildings and other allied work at Port Point; Project 2, aluminum production line including required buildings, line and allied work at Port Neches; Project 3, 40,000 kw. powerhouse at Port Lavaca; Project 4, 40,000 kw. powerhouse at Port Neches. Estimated cost \$11,250,000

Tex., Port Neches—Jefferson Chemical Co., Port Neches, has awarded the contract for Unit 1 of chemical manufacturing plant to C. F. Braun Co., 1000 South Fremont Ave., Alhambra, Calif. Estimated cost \$1,245,000

W. Va., Clarksburg—National Carbon Co., Clarksburg, has awarded the contract for a manufacturing plant to Henry Haselbacher & Sons, Clarksburg. Estimated cost \$85,000

W. Va., Martinsburg—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., will construct an explosives plant along the Potomac River about 8 mi. from here. Work will be done with own forces

Wis., Green Bay—Northern Paper Mills, Green Bay, has awarded the contract for a 3 story evaporator building and a 3 story boiler house to Selmer Co., Northern Bldg. Estimated cost \$100,000 and \$200,000 respectively.

1932... 1951



**Year after year
on drum after drum**

GULF
is protected by
Tri-Sure Closures

BACK in 1932, when Tri-Sure Closures* were first introduced, the Gulf Oil Corporation started to use them to protect their products from leakage, substitution and pilferage.

For 19 years, Gulf has been sending shipment after shipment—to customers all over the world—in drums equipped with Tri-Sure Closures.

The fact that Gulf, one of the world's largest shippers of oil and gasoline, is entrusting its famous products to Tri-Sure Closures is evidence of the complete dependability of the Tri-Sure Flange, Plug and Seal.

Give your product Tri-Sure protection—relied on as insurance against leakage and losses by the world's leading shippers. On your next drum order specify "Tri-Sure Closures"—and make every shipment a safe shipment.

*The "Tri-Sure" Trademark is a mark of reliability backed by 28 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used.



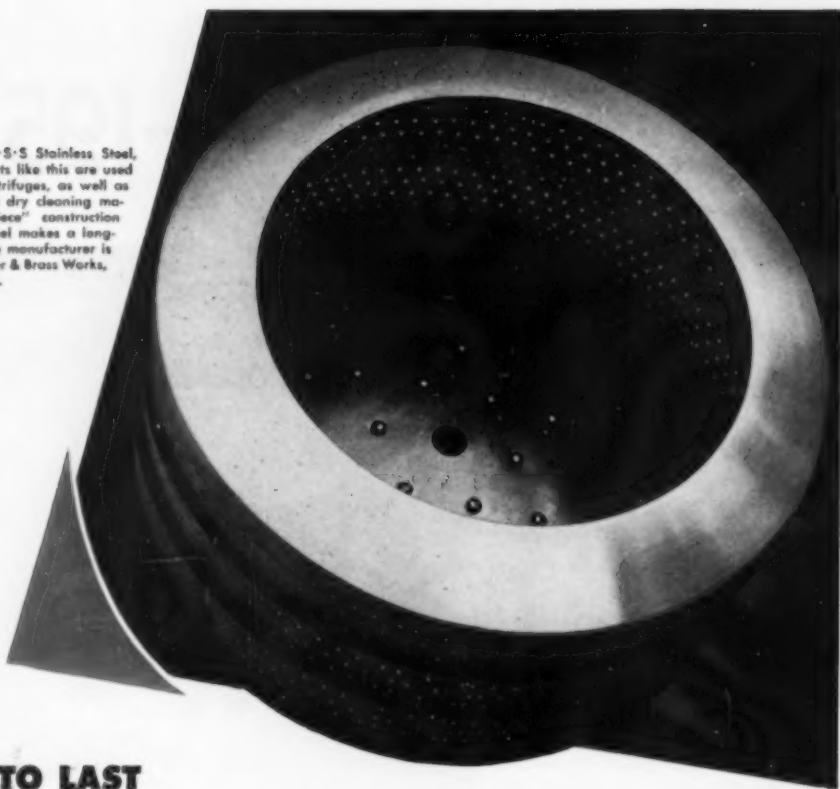
Tri-Sure

CLOSURES

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA

CHEMICAL ENGINEERING—April 1951

Made from U-S-S Stainless Steel, extractor baskets like this are used in chemical centrifuges, as well as for laundry and dry cleaning machinery. "One-piece" construction from Stainless Steel makes a long-lasting basket. The manufacturer is the Hamilton Copper & Brass Works, Inc., Hamilton, Ohio.



MADE TO LAST

... it's U-S-S Stainless Steel

How many times during recent months have you stopped in front of a vital piece of equipment and said to yourself, "I'm glad it's Stainless Steel"?

Like thousands of other users, your selection of Stainless Steel equipment has been justified by its performance. Because Stainless equipment is made to last, it reduces production losses and postpones equipment replacements that are so difficult (sometimes even impossible) today. For Stainless has exceptional resistance to the corrosive conditions

and high temperatures common to the chemical processing industry. And its strength, toughness and hard, dense surface give it the ability to stand up under the most severe wear.

Include Stainless Steel equipment in your plans for future improvements. By using U-S-S Stainless Steel wherever and whenever possible, you make sure you get a perfected, service-tested material that has proved unsurpassed for keeping equipment on the job.

AMERICAN STEEL & WIRE COMPANY, CLEVELAND

COLUMBIA STEEL COMPANY, SAN FRANCISCO • NATIONAL TUBE COMPANY, PITTSBURGH • TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL COMPANY, PITTSBURGH • UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST



U-S-S STAINLESS STEEL

SHEETS • STRIP • PLATES • BARS • BILLETS • PIPE • TUBES • WIRE • SPECIAL SECTIONS

UNITED STATES STEEL

1-532

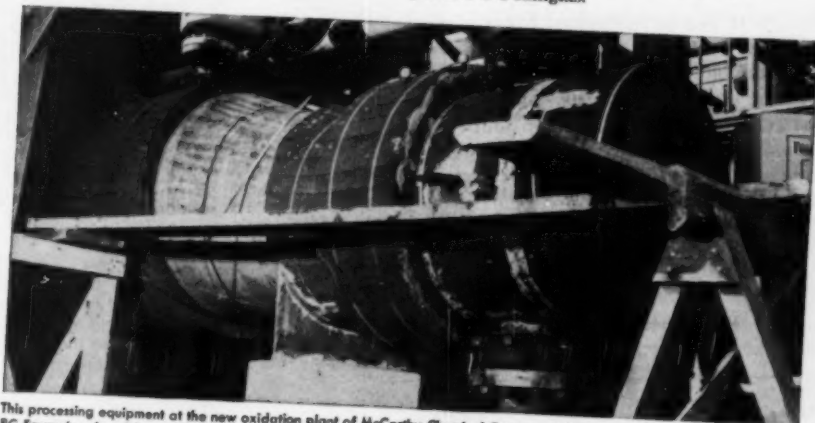
It costs you less money

**PC
FOAMGLAS**
the long life
insulation

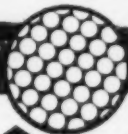
The wide acceptance of PC Foamglas—evidenced by a long list of prominent users—is due mainly to two facts. It is an effective insulation. It is an economical insulation.

Its cellular glass structure enables Foamglas to give many years of efficient, trouble-free insulating service on hot and cold piping and fittings—indoors and outdoors—on towers, tanks, and processing equipment. Its freedom from costly maintenance, repairs and replacement is another important factor in keeping insulating costs down to rock bottom.

When next you figure on insulation, consider the money-saving advantages of Foamglas on a cost-per-year basis. If you are facing special insulating problems, our specialists will be glad to consult with you. Meanwhile, you will find a lot of helpful information in our current literature. Just send in the convenient coupon and your free copy of our booklet will be forwarded promptly, with a sample of PC Foamglas.



This processing equipment at the new oxidation plant of McCarthy Chemical Company, Winnie, Texas, is being insulated with PC Foamglas. In addition to curved segments, beveled lags and standard flat blocks on equipment, preformed sections of Foamglas have been used on pipe lines at this plant. Insulation Contractor: The Aber Company, Inc., Shreveport, Louisiana.

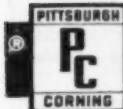


This diagram shows how a group of glass bubbles, which contain still air, can form a continuous, cellular material. The black area is glass, the white space is air. PC Foamglas, the cellular glass insulating material, consists of glass and still air, makes an excellent barrier to heat travel. And, being glass, Foamglas has unusually high resistance to moisture, vapor, fumes and acid atmospheres, is noncombustible, odorless and verminproof. In this cellular glass construction lies the secret of the long lasting insulation value of PC Foamglas.

Pittsburgh Corning Corporation
Dept. CC-41, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me without obligation, a sample of Foamglas and your FREE booklet on the use of PC Foamglas insulation for industrial insulation.

Name
Address
City State



FOAMGLAS cellular glass INSULATION

... when you insulate with FOAMGLAS ... the insulation lasts!



Hystrene* stearic acids give you the whip-hand over fatty acid ingredients

HYSTRENE stearic acids open new avenues to superior fatty acid products—soaps, esters, metal stearates—because these acids represent a completely different concept of stearic acid purity. Never before has stearic acid been available commercially at such high *true stearic content* or so completely free of unsaturates, unsaponifiables—undesirable elements that cause darkening at elevated temperatures.

What does this mean to your operation? Frankly, we don't know all the answers for all industries ourselves. But, our experiments *do* prove you can make lighter-colored, more stable esters than possible with ordinary commercial stearic acids. You can use HYSTRENE acid alone—or you can mix the exact stearic-palmitic-oleic mixture you desire, with confidence that your stearic portion is virtually free of trouble-making impurities. In this way, HYSTRENE acids offer you an original and fresh approach to improvements in temperature stability, color, odor, and shelf-life of your product.

There is no premium price on HYSTRENE stearic acids. Write for research samples.

HYSTRENE SPECIFICATIONS

	HYSTRENE T-70 (70% true stearic acid)	HYSTRENE S-97 (97% true stearic acid)
Titer (Average, °C.)	62	66.3
Iodine Value (Wils)	0.5 Max.	0.8 Max.
Unsaponifiables (%)	0.15 Max.	0.25 Max.
Color (Lovibond, 5 1/4" Cell)	1 1/2 Y-0.2R Max.	3 Y-0.3R Max.
Free Fatty Acid	101-102	100.0-100.5
Acid No. (Average)	200.2	197.3
Saponification No. (Average)	200.6	197.6
Max. Difference between Acid No. and Sap. No.	0.5	0.5

*HYSTRENE: Trade Mark of Trendex Co., Inc.

ATLAS

INDUSTRIAL
CHEMICALS
DEPARTMENT



ATLAS POWDER COMPANY, Wilmington 99, Del. • Offices in principal cities • Cable Address—Atpowco
ATLAS POWDER COMPANY, CANADA, LTD., Brantford, Canada

ATLAS CHEMMUNIQUE

Polyol from Sun and Soil Helps Stabilize Supply

While prices and supplies fluctuate wildly for other types of polyhydric alcohol, the supply of *sorbitol*, made by Atlas from natural sugars, has climbed steadily in the last 15 years, and price has remained comparatively steady, with a general downward trend. A primary product, from replaceable resources, its promise is unlimited and manufacturing facilities are being doubled in 1951.

Which explains why many manufacturers of tobacco, glue products, resins, pharmaceuticals and foods are turning to sorbitol for a steady future supply of polyol for moisture-conditioning and synthesis.

New Methods for Testing Agricultural Emulsions

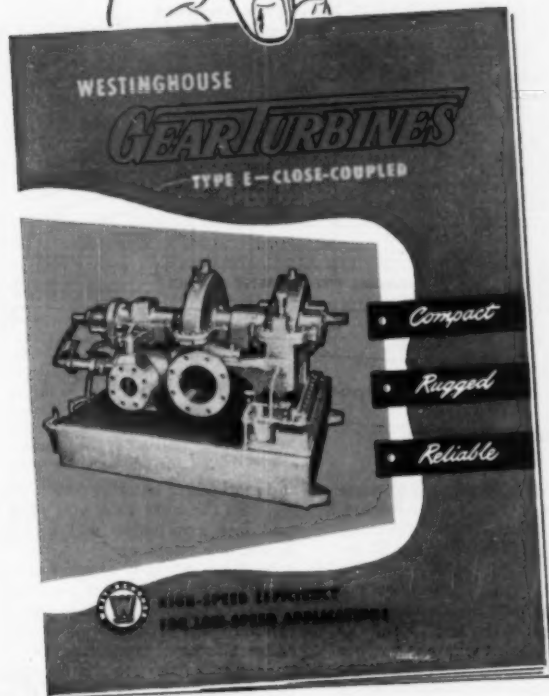
A new booklet published by Atlas shows a practical method for testing agricultural emulsions, gives detailed plans for an emulsion testing rack. Formulas for 39 insecticides and herbicides are included, showing how to select and use the complete line of Atlox® emulsifiers with 14 different toxicants. Write for "Atlox Surface Active Agents for Formulating Agricultural Chemicals."

*Reg. U.S. Pat. Off.



A gearturbine built to save...

Three ways



The Westinghouse Gearturbine costs less to buy... less to install... and less to maintain. Wrapped up in a single package is a compact, rugged and reliable speed-reduction unit solidly coupled to a Type E turbine. It's the ideal combination for ratings up to 500 hp and output speeds commonly found in single-ended applications.

Here's economy made possible by a standardized design that cuts manufacturing costs... avoids costly specials... saves space... and simplifies maintenance. And you get the maximum flexibility possible... any combination of three turbine wheel sizes, three gears and three types of governor can be used according to your needs.

Other plus features are... solid coupling of turbine shaft to pinion shaft; single-helical gearing; forced circulation, filtered oil; and 3-point support for easy mounting and leveling.

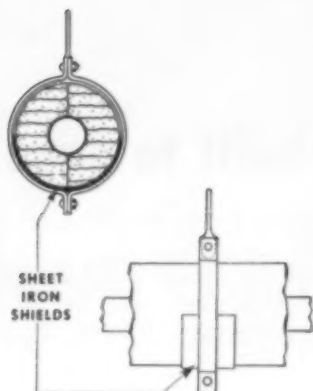
J-50521

GET THE FULL STORY. A newly available booklet, B-4346, clearly explains the applications, refinements and advantages of Westinghouse Gearturbines. Ask your nearby Westinghouse representative for your copy, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.



**YOU CAN BE SURE... IF IT'S
Westinghouse**

TYPE E Turbines



WE HAVE BEEN ASKED:

What is the proper spacing of hangers to support cork insulated lines?

Recently we received a letter which posed the following problem:

"We are redesigning some process piping, and we want to make sure that we correctly space the hangers on our cold lines to avoid compression of the cork covering."

To answer his question we sent this manufacturer the graph shown above. It is a dependable guide to the efficient spacing of hangers. Here's an example of how it works:

Let's assume that lines are filled with liquid weighing 90 lbs. per cubic foot. Shields are 10" long—made of 16-gauge sheet iron—and enclose half the circumference of the covering. Now let's assume that

we are going to insulate a 6" pipe with standard thick cork covering. First, draw a red line, as we've done on the graph above, from the 6" indication at the bottom of the graph to the point where it intersects the line marked Cork, Standard. Then carry the line to the left. Read the figure at the point where it reaches the left-hand margin. That figure tells how many feet apart hangers should be spaced. Under the conditions of this problem—12½ feet.

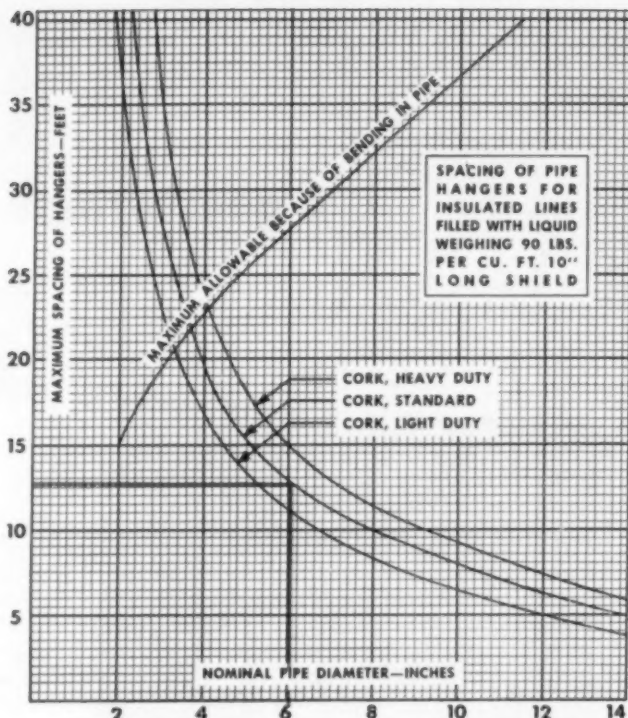
While this chart applies only to liquids weighing about 90 pounds per cubic foot and for 10" shields of 16-gauge sheet iron, similar charts can be developed for other liquids

and methods of hanging cork covering. So the next time you plan a cold line installation call in your Armstrong engineer.

He'll be able to give you the best hanger specification for your particular needs. You'll find that he can help you in other ways, too, because almost every insulation job presents some problems that his knowledge and experience can help solve.



IF YOU HAVE ANY QUESTIONS on low- or high-temperature insulations, feel free to call the engineer in your nearest Armstrong district office or write to the Armstrong Cork Company, 3304 Concord Street, Lancaster, Pennsylvania.



ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.



American Blower... a time-honored name in air handling



Toledo, too, has a conveniently located American Blower Branch Office to provide you with data and equipment for air handling. You can reach American Blower in Toledo by calling Lawndale 7297. In other cities, consult your phone book.



COOLING...

American Blower's reputation for high quality has made them an important source of supply for many original equipment manufacturers. A leading maker of refrigeration equipment, for example, relies on American Blower almost exclusively for the fans and blowers used in his units. As he says: "We know refrigeration. You know air handling. Together, our teamwork and high standards of quality results in an end product second to none." Can you use the American Blower team in your field?



HEATING...

Being able to eliminate a central heating system with self-contained gas-fired unit heaters is a big advantage in those small but neat new stores and shops

springing up everywhere. American Blower Gas-Fired Unit Heaters are not only highly efficient but harmonize beautifully with modern interiors. A.G.A.-approved, they are available in a wide range of sizes to meet many different commercial needs. Our nearest branch office will give you complete data and prices.



VENTILATING...

As an added sales feature for new homes and multiple dwelling units, builders find American Blower Aeropel Fans a natural. One builder recently installed 300 in a housing project. Found the response so good he's making them a standard feature. Aeropel Fans have won two Fine Arts Awards for beauty and utility in the home. They're ideal for ventilating kitchens, basements, recreation and utility rooms—are reasonably priced and easy to install.

MAY WE SERVE YOU?

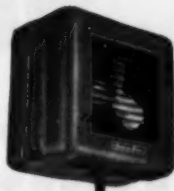
American Blower heating, cooling, drying, air conditioning and air handling equipment can do much toward improving comfort and efficiency in business. For data, phone or write our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary Corporation

YOUR BEST BUY **AMERICAN BLOWER** AIR HANDLING EQUIPMENT

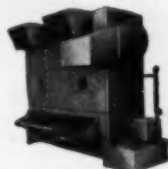
Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATION • KENAWEE BOILER • ROSS HEATER • TOWNAHAWK IRON
CHEMICAL ENGINEERING—April 1951



Unit Heaters



Ventura Fans



Air Conditioning Equipment



Industrial Fans



Utility Sets

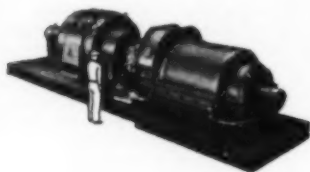
Need Air or Gas Handling Equipment?

ALLIS-CHALMERS OFFERS 5 TYPES FOR CHEMICAL PROCESSING!



SINGLE STAGE BLOWERS

Discharge nozzle can be arranged in any of 24 positions. Cast casing provides rigidity, longer life, smoother operation . . . deadens machine noises, eliminates vibration. Available in pressure ranges from 1 to 6.50 lb.



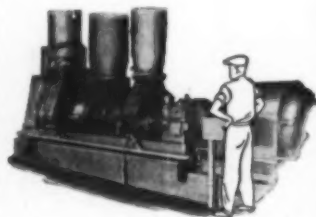
MULTI-STAGE BLOWERS

Centrifugal type, for boosting, exhausting, circulating. Cannot build up dangerous pressures. Have enclosed backward-bladed impeller wheels. Pressure volume curve favorable to parallel operation. Capacities to 150,000 cfm.



ROTARY COMPRESSORS

Sliding vane type. Air is compressed in cells formed by blades moving freely in and out of longitudinal slots in rotor eccentric to its casing. Quiet, smooth operation. Units start unloaded. Capacities from 5 to 35 psig.

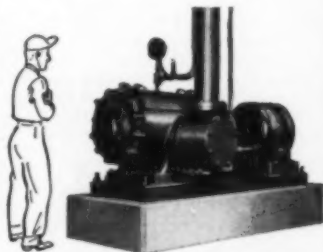


AXIAL COMPRESSORS

Good base load machines. Handle large fixed volumes of air with pressure variations over a wide range. Used in connection with gas turbines and for high velocity wind tunnel operations. Able to compress to 50 lb G with high efficiencies. Cannot build up dangerous pressures.

DRY VACUUM PUMPS

Same principle as rotary compressors with exception that inlet is connected to chamber to be evacuated and exhaust is open. No inside valves. Saves floor space. Range from 10 to 28 in. Hg, 55 to 5750 cfm, 3 to 250 hp.



WHETHER YOUR PROCESS calls for aeration, agitation, circulation, or combustion, Allis-Chalmers can meet your particular need from its wide range of air and gas handling equipment.

A-C will design to your exact job requirement and will build standard or special, as required. Each of the five types shown can be supplied specifically engineered for corrosive gases . . . for close control of pressure and volume . . . for automatic or manual operation and other variable factors.

Allis-Chalmers has been building air and gas handling equipment and their drives for over half a century. All the

equipment shown on this page is Allis-Chalmers designed and built!

Put this experience to work for you! A-C will build you a completely integrated installation; blower, compressor or pump . . . electric motor or gas or steam turbine drive . . . manual or automatic flow or pressure control. Call or write your nearest Allis-Chalmers office for information or literature.

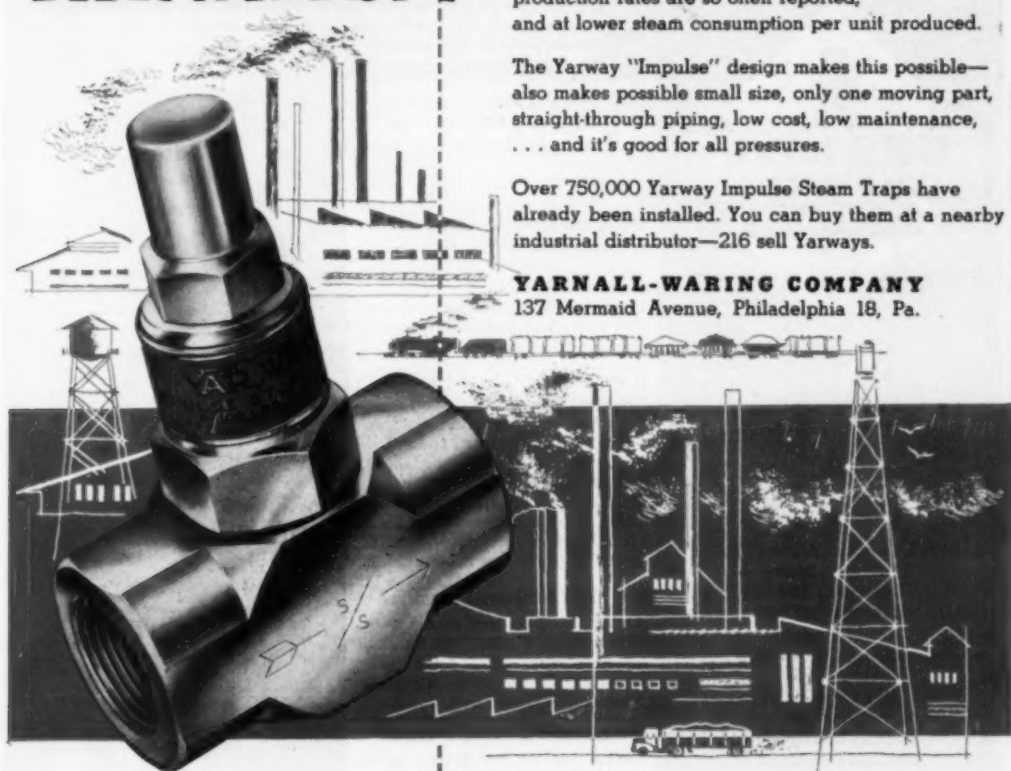
ALLIS-CHALMERS, 1147A SO. 70 ST
MILWAUKEE, WIS.

A-3205

ALLIS-CHALMERS



PRODUCE MORE WITH YARWAYS...



Is higher production your aim?

Then Yarway is your steam trap. Best steam trap performance requires condensate drainage *plus*—

1. Air and gas removal.
2. Velocity scrubbing of condensate from heat transfer surfaces.
3. Keeping highest average temperature in the equipment.

Yarway Impulse Steam Traps do all this, sending the most premium B.T.U.'s at top temperature into your process or product.

That's why equipment drained with Yarways gets "hotter, sooner" . . . why better quality and higher production rates are so often reported, and at lower steam consumption per unit produced.

The Yarway "Impulse" design makes this possible—also makes possible small size, only one moving part, straight-through piping, low cost, low maintenance, . . . and it's good for all pressures.

Over 750,000 Yarway Impulse Steam Traps have already been installed. You can buy them at a nearby industrial distributor—216 sell Yarways.

YARNALL-WARING COMPANY
137 Mermaid Avenue, Philadelphia 18, Pa.

FREE OFFER

Don't take our word for it. Test Yarway's production advantages in your own plant, without cost or obligation. Drop us a card. A trial trap will be delivered promptly.

YARWAY the steam trap
designed with production
in mind



THE NAME TO WATCH IN CHEMICALS

*A partial list of
other Oronite Chemicals*

NOTICE

Some of the following are
currently in short supply.

Detergent Alkalis
Detergent Slurry
Detergent D-40
Detergent D-60
Wetting Agents
Lubricating Oil Additives
Cresylic Acids
Gas Odorants
Polybutenes
Sodium Sulfonates
Purified Sulfonate
Naphthenic Acids
Phthalic Anhydride
Ortho, Para Xylenes
Xylol
Aliphatic Acid
Hydroformic Catalyst

Background for better detergents

More than a billion pounds of household and industrial cleaning compounds have been produced with synthetic detergent materials made by Oronite.

This broad acceptance is proof of the high regard which leading compounders, processors and end-users hold for Oronite products. Large-scale production facilities and experience provide Oronite the background for better detergents and make Oronite a most important source of supply.

THESE EXTREMELY VERSATILE SYNTHETIC
DETERGENTS FIND A WIDE VARIETY OF
USES THROUGHOUT INDUSTRY

Four Examples:

1. FOOD AND VEGETABLE PROCESSING

A tremendous aid in washing, peeling and processing fruits and vegetables before canning or freezing. Improves their marketability and aids in the removal of dirt, insecticide and fertilizer residue.

2. UPHOLSTERING AND RUG CLEANING

These detergent products find widespread use in plant or "on-location" cleaning of rugs, carpets and upholstery. Excellent foaming qualities, easy rinsing and high efficiency in cleaning greasy type soil make them ideal for this purpose. Use them straight or in special compounds depending upon type of application.

3. CLEANING AND WASHING COMPOUNDS

Oronite supplies tremendous quantities of synthetic detergent materials to processors and compounders of packaged cleaners for all household and industrial uses.

4. TRANSPORTATION EQUIPMENT WASHING

Because of its fast action, quick rinsability and high detergency, Oronite D-40, either alone or in compounds, cuts cleaning and maintenance costs on trucks, trains, busses, passenger cars and other types of rolling stock.



ORONITE CHEMICAL COMPANY

38 SANSOME STREET, SAN FRANCISCO 4, CALIF.
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
824 WHITNEY BLDG., NEW ORLEANS 12, LA.

STANDARD OIL BLDG., LOS ANGELES 15, CALIF.
600 S. MICHIGAN AVENUE, CHICAGO 5, ILL.

ALL-METAL EQUIPMENT USED TO PRODUCE DE-IONIZED WATER

**Mineral content reduced to
less than 10 parts per million**

The equivalent of distilled water, with a mineral content of less than 10 ppm—a 96% reduction—is flowing from the all-Monel de-ionizing system at the Swansboro Ice Company, Swansboro, North Carolina.

This equipment operates on the two-stage cation- and acid-removing principle. In the first stage, mineral salts are converted to their equivalent acids by exchanging the original cations for hydrogen ions. The second stage removes the entire acid molecule, leaving the effluent water free from the original dissolved solids.

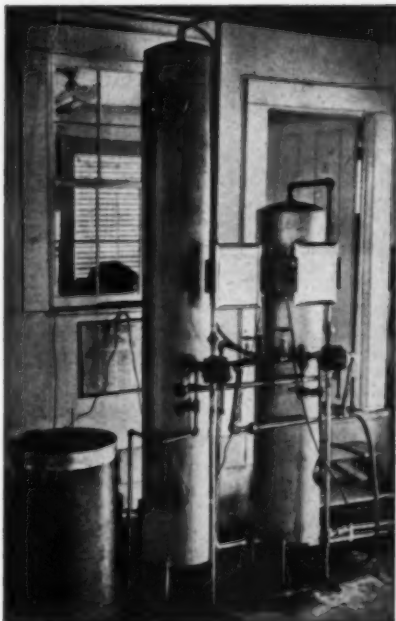
This is the only process, other than distillation, which removes all ions from water. But since such high purity water is obtained by de-ionization, even a trace of metal pick-up can seriously alter the final purity.

Therefore, metal equipment used must be virtually inert to the water carried through it. For several years, piping and fittings of Monel had been used in de-ionization, but it was not realized that entire units could be made of Monel. Then, with the Swansboro installation, it was proved that Monel's resistance to water was so high that metal pick-up from it would affect water purity negligibly, if at all.

After the equipment had been in use for an entire summer, producing 500 gallons of de-ionized water an hour, the fabricator, Hungerford & Terry, Inc., of Clayton, New Jersey, reported that there had been no detectable metal pick-up from the Monel surfaces.

If you have a high-purity problem, here is a practical suggestion:

Write INCO's Corrosion Engineering Service, outlining the problem. They will be glad to suggest materials that will help you—either for immediate defense requirements or for future installations.



This all-Monel de-ionization unit, in service at Swansboro Ice Company, Swansboro, N. C., reduces the mineral content of well water from 250 ppm to 10 ppm, with flow of 500 gallons an hour. The entire unit is Monel, except the side tanks containing regenerating materials—yet after a full summer's operation, there had been no detectable metal pick-up, according to the fabricator, Hungerford & Terry, Inc., Clayton, N. J.

ENGINEER OF SERVICE
NICKEL INCO ALLOYS

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL • "S"® MONEL
NICKEL • LOW CARBON NICKEL • DURANICKEL®
INCONEL® • INCONEL "X"®

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N.Y.



Instrument

NEWS

B. F. Goodrich Adds G-E Mass Spectrometer To New Research Facilities



B. F. Goodrich scientists say their General Electric mass spectrometer will get solutions to new problems plus new approaches to old problems. The creation of new products will be speeded by the G-E instrument, they say. The G-E spectrometer was purchased in line with the B. F. Goodrich policy of using the latest scientific equipment.

With automatic operation and immediate high-speed pen recording, results are obtained at once. A wide range permits work on most chemical compounds. General Electric offers complete advisory service to present and prospective users, including analysis of compounds.

Laboratory Air Policed by G-E Mercury-vapor Detector Instantly Detects Dangerous Mercury-vapor Concentrations



Dr. Samuel Moskowitz, New York State Labor Dept., says that his General Electric mercury-vapor detector is a vast improvement over slower methods. The detector is accurate within 5%.

Sixteen state governments, five foreign governments, medical groups, insurance companies and industrial laboratories are safeguarding personnel with G-E mercury-vapor detectors.

Philadelphia Gets Spring Water With Help of G-E Recorder



Welsbach Corporation of Philadelphia uses a General Electric dew-point recorder in its ozonizing of water from the Schuylkill River. Ozonizing gives the water a spring-water taste.

The G-E recorder was chosen because it gives a continuous record of moisture in a gas stream. High-altitude, food, chemical, weather, air-conditioning and refrigeration laboratories now use General Electric dew-point recorders.

G.E. Announces New Plan for Mass Spectrometers

To give present and future mass spectrometer users the chance to modernize or build their own equipment, General Electric now offers spectrometer components, including the tubes shown below. Other components available are the ion gage, emission regulator, d-c amplifier, magnet power supply and high-voltage power supply.

Owners and builders can get expert advice on spectrometry without charge.



Conventional tube



Bennett RF tube



Ion-resonant tube



GENERAL ELECTRIC

Section C 687-58, Apparatus Department
General Electric Company, Schenectady, New York

Please send me the following bulletins

- ☐ GEC-312 mercury-vapor detector
☐ GEC-587 mass spectrometer
☐ GEC-588 dewpoint equipment
☐ GEC-696 mass-spectrometer tubes and components

- ☐ need for reference purposes
☐ planning an immediate project

Name _____ (please print)

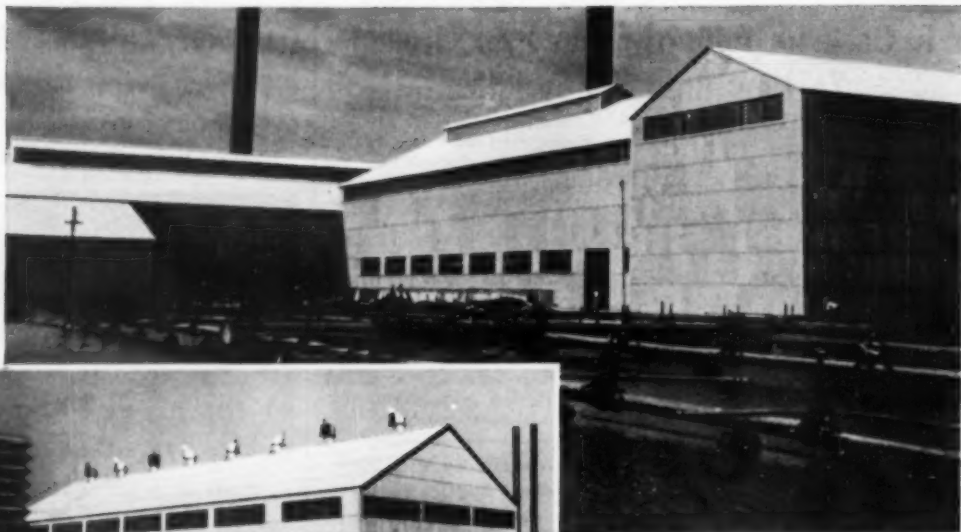
Position _____

Address _____

City _____ Zone _____ State _____

CORRUGATED TRANSITE* ... At home, and abroad!

*Transite is a registered Johns-Manville trade mark



• Above: Walls and roofs of Corrugated Asbestos Transite on a sugar refinery in the Dominican Republic



• Left: High resistance to corrosive fumes makes Corrugated Transite a logical choice for the walls and roof of this gas plant in Texas

Long a favorite in the U.S.A., tough Asbestos Transite building sheets now have international acceptance

Fireproof, rotproof, weatherproof, Corrugated Asbestos Transite helps everywhere to achieve enduring construction, streamlined simplicity, lower construction and maintenance costs.

In war or peace, at home and abroad, Corrugated Asbestos Transite is a busy building material because it provides advantages that have universal importance.

These tough Transite sheets for walls and roofs are maintenance-free ... can't

rot, rust, or burn. Never need paint to preserve them ... practically no upkeep, because they're made of materials that are virtually indestructible—asbestos and cement. The natural light gray color of Transite is attractive without further decoration.

The large sheets go up fast, require a minimum of framing, lend themselves attractively to modern streamlined design. The corrugations cast pleasing shadow lines and enable you to develop architectural effects.

You can combine the Transite sheets with insulating materials for curtain walls. You can also use them to create beautiful and practical interior wall facings or partitions.

When need for alteration arises, the sheets are almost 100% salvageable. If you plan to build—and particularly if you have a problem of industrial expansion for military defense—investigate the possibilities of Corrugated Transite. Write Johns-Manville, Box 158, Dept. FM, New York 16, N. Y.



EASY TO FASTEN TO STEEL



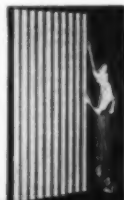
EASY TO SAW



EASY TO DRILL



EASY TO NAIL TO WOOD



Johns-Manville

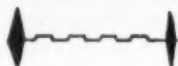
Asbestos

CORRUGATED TRANSITE



HOW IT WORKS

Supersonic waves are sent into the material under test. Upon reaching the other side, or upon reflection by a discontinuity, the waves return to their source and are then converted into a high-frequency potential. This potential is amplified by electronic circuits and projected upon the screen of a cathode-ray tube where they may be seen and examined.



Pulse pattern, showing the initial pattern at the extreme left and the reflection from the opposite side at the extreme right. The sweep line indicates no defects.



A typical indication of a defect is illustrated here. By means of calibration, it is now possible to determine both the exact position of the flaw, as well as its size.

Today, Supersonic testing is available on specification for inspecting Grinnell prefabricated piping. By observing the pattern produced by the electron beam on the fluorescent screen, any defects in the base metal, welds, or variations in pipe thickness can be located and measured at a glance.

Grinnell's ultra modern electronic testing can be relied upon to detect hidden flaws in pipe materials, to check unerringly the quality of welds where it picks up types of flaws not revealed by X-ray and gamma ray inspection. In examining bends, this type of testing can measure the degree to which bent pipe thins on the outside and thickens on the inside of the bend, assuring full specified thickness in high temperature, high pressure work.

Non-destructive Supersonic testing is another in a constant succession of new techniques employed by Grinnell to provide prefabricated piping which is safe and dependable . . . which measures up in every way to rigid state, national, association and insurance code requirements. It is another reason, too, why it will pay you to think of Grinnell "Whenever Piping Is Involved".

GRINNELL

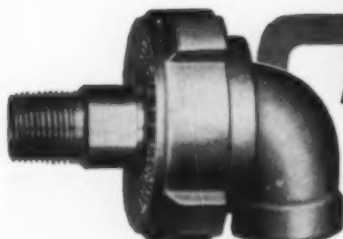
WHENEVER PIPING IS INVOLVED



GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago
Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York
Oakland • Philadelphia • Peconic • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

BARCO *Flexible Rotary* SWIVEL JOINTS

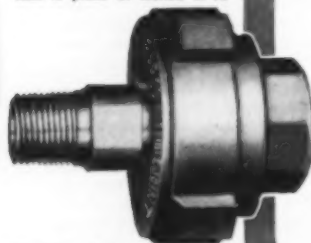
For Handling
STEAM · AIR · WATER · GAS
and **CHEMICALS!**



Model SA-7AS-8CS—Industrial Type Swivel Joint for angle connection. Sizes $\frac{1}{4}$ " to 2".



A TYPICAL APPLICATION—To provide a piping connection from Point A (moving) to Point C (fixed). Install joint at A with axis normal to plane of motion of A. Install joints at B and C with axes parallel to axis of joint at A. Locate joints in plane parallel to plane of motion of A.



Model SA-7S-8CS—Industrial Type Swivel Joint. Sizes $\frac{1}{4}$ " to 2".

HERE'S how to make piping connections to steam jacketed tilting kettles, low speed* revolving drums and rolls, press platens, and other moving equipment—Use Barco Flexible Swivel Joints!

FOR BETTER ENGINEERING! Put flexibility where you want it — without the nuisance of sagging, flopping, non-rigid lines. Easy to position lines accurately. No restricted internal diameters.

NO BINDING—LOW FRICTION, LOW TORQUE! Barco's exclusive design provides for side flexibility — perfect alignment not necessary to prevent binding. Where required, joints can be supplied with no side flexibility.

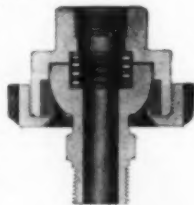
PRESSURE SAFE! The seal will not break or blow out suddenly. High temperature and fire resistance. No swelling or expansion under pressure. Built for pressure ratings as high as 3,000 p.s.i., or higher under certain conditions. No leakage under varying conditions of vacuum and pressure. Joints function perfectly at extremely low and high temperatures.

Barco factory and field engineers will be glad to help you solve your problems. Wide choice of styles and sizes available from $\frac{1}{4}$ " to 2". Ask for latest illustrated literature. **BARCO MANUFACTURING CO.**, 1816 E Winnemac Ave., Chicago 40, Ill. In Canada: The Holden Co., Ltd., Montreal.

*Ask about the new Type 1B Revolving Joint for higher speed applications.



ROTARY SWIVEL JOINT (Left)
Latest advanced design—very low torque! 360° swivel action, plus side flexibility. Excellent for low speed rotary joint applications up to 30 RPM.



REGULAR SWIVEL JOINT (Right)
Long standard in industry. Provides 360° swivel movement with side flex to take care of piping misalignment.

BARCO

THE ONLY TRULY COMPLETE LINE OF
FLEXIBLE, SWIVEL, SWING AND REVOLVING JOINTS
Worldwide Sales and Service

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

Over
7

MILLION SQUARE FEET OF

KAYLO.
INSULATING
ROOF TILE

...Placed in the 2½ Years
Since its Introduction



EASY APPLICATION of Kaylo Insulating Roof Tile expedites the completion of flat or pitched roofs. Standard roofing materials are used over a Kaylo roof deck.



Kaylo Insulating Roof Tile is selected for more and more buildings of all kinds because it offers a combination of advantages unmatched by any other roof deck material:

Incombustibility of Kaylo Tile assures protection against fire;
Insulating Value eliminates the need for additional insulating materials under all but severe conditions;
Structural Strength is more than adequate for typical roof loads;
Light Weight permits the use of lighter supporting structural members;
Inorganic Composition resists rot—moisture does not damage Kaylo Insulating Roof Tile.

It will pay you to investigate these advantages.

KAYLO... FIRST IN CALCIUM SILICATE

...pioneered by

OWENS-ILLINOIS GLASS COMPANY

Kaylo Division • Toledo 1, Ohio

SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Detroit
Houston • Minneapolis • New York • Oklahoma City • Philadelphia
Pittsburgh • St. Louis • Washington

SEND COUPON FOR KAYLO ROOF TILE LITERATURE!

OWENS-ILLINOIS GLASS COMPANY
Kaylo Division, Dept. H-179 • Toledo 1, Ohio
Gentlemen: Please send me literature on Kaylo Roof Tile.

NAME.....
FIRM.....
ADDRESS.....
CITY.....STATE.....



SOLID PORCELAIN



Lapp PORCELAIN VALVE

● Valves of Lapp Chemical Porcelain are known in the chemical processing industry as the most effective for handling many corrosive chemicals. And *porcelain* is the body material itself, not a paint or enamel. The porcelain is dense, homogeneous, *non-porous, through-and-through* acid resisting. Not even is the corrosion resistance of this material due to a glaze. In fact, the smooth operation and pressure-tight seal

is the result of machining—grinding and lapping the solid porcelain—which is finished to an accurate, mirror-like smoothness.

In many points in the chemical industry, Lapp valves have been found the only satisfactory answer to the problem of handling corrosive chemicals. Perhaps they can save trouble for you, too. Lapp Insulator Co., Inc., Process Equipment Division, 403 Maple St., LeRoy, N.Y.

Lapp

PROCESS EQUIPMENT

CHEMICAL PORCELAIN VALVES • PIPE • RASCHIG RINGS
PULSAFEEDER • CHEMICAL PROPORTIONING PUMPS



CHEMICAL PORCELAIN BULLETIN NOW AVAILABLE

Chemical and mechanical characteristics of Lapp Porcelain; specifications and dimensions for valves, pipe, raschig rings, towers; installation procedure and maintenance hints. Write for your copy.

FOR MAXIMUM PERFORMANCE AND LONG LIFE
OF ELECTRICALLY-OPERATED EQUIPMENT

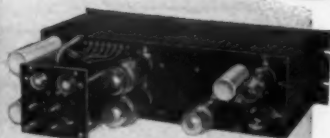
Invest in



STABILINE

Automatic

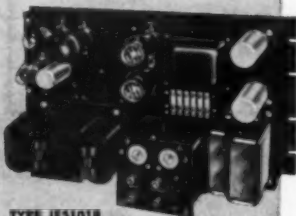
VOLTAGE REGULATORS



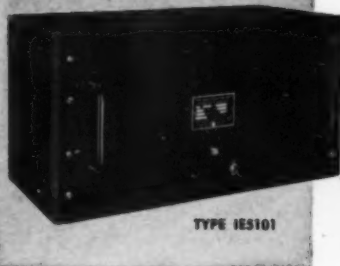
TYPE IES1002R



TYPE
IES1005



TYPE IES101R



TYPE IES101

Manufacturers faced with the need for increased production and lower costs are becoming extremely conscious of the importance of maintaining constant voltage to electrical apparatus. The Superior Electric Company's line of STABILINE Automatic Voltage Regulators offers equipment to suit the needs of each application. Two types are available: Type IE (Instantaneous Electronic) and Type EM (Electro-Mechanical).

STABILINE Type IE is a completely electronic unit with no moving parts . . . is used where instantaneous and extremely close correction is required. It maintains a constant output voltage regardless of line variations at no load, full load or any intermediate load. The output voltage is held to within ± 0.1 volts of nominal for wide line variations; within ± 0.15 volts of nominal for any load current change or load power factor change from lagging .5 to leading .9. Maximum waveform distortion never exceeds 3%.

Standard models are available in cabinets or for relay rack mounting in numerous ratings as listed below. In the event you have a special requirement involving other frequencies or ratings, SECO voltage control engineers will study your specific problem and make recommendations without obligation.

INSTANTANEOUS ELECTRONIC CABINET MODELS

Input Voltage Range	Output Voltage Range	Frequency In Cycles	Load Range In Amperes	Load Power Factor Range	Rated Output KVA	Type
95-135	110-120	60 \pm 10%	0 - 2.2	.5 lagging	0.25	IES1002*
195-255	220-240	60 \pm 10%	0 - 1.1		0.25	IES2002*
95-135	110-120	60 \pm 10%	0 - 4.5		0.5	IES1005*
195-255	220-240	60 \pm 10%	0 - 2.2		0.5	IES2005*
95-135	110-120	50 \pm 10%	0 - 4.5		0.5	IELS1005*
195-255	220-240	50 \pm 10%	0 - 2.2	to .9 leading	0.5	IELS2005*
95-135	110-120	60 \pm 10%	0 - 8.5		1.0	IES101*
195-255	220-240	60 \pm 10%	0 - 4.5		1.0	IES201*
95-135	110-120	50 \pm 10%	0 - 8.5		1.0	IELS101*
195-255	220-240	50 \pm 10%	0 - 4.5		1.0	IELS201*
95-135	110-120	60 \pm 10%	0 - 22.0		2.5	IES102*
195-255	220-240	60 \pm 10%	0 - 11.0		2.5	IES202*
95-135	110-120	50 \pm 10%	0 - 11.0		2.5	IELS202*
195-255	220-240	50 \pm 10%	0 - 43.5		3.0	IES105
95-135	110-120	60 \pm 10%	0 - 22.0		5.0	IES205

* Also offered in rack models.

REMEMBER, STABILINE TYPE EM (ELECTRO-MECHANICAL) UNITS ARE ALSO AVAILABLE. RATINGS FROM 2 TO 100 KVA. LITERATURE ON REQUEST.

There's a STABILINE Automatic Voltage Regulator for every need. Send today for literature and specific information. Write The Superior Electric Co., 204 Church St., Bristol, Conn.

THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT



POWERSTAT VARIABLE TRANSFORMERS • VOLTAGE A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS

LOOK TO DOW FOR

Diethyl Malonate



readily available!



Attention pharmaceutical manufacturers! Diethyl Malonate is *readily available* at Dow. If you use this important chemical intermediate, order from Dow.

Diethyl Malonate is widely used in the manufacture of barbiturates. And, because it is an excellent "building block", it is used in the syntheses of chemical intermediates and organic pigments.

You can rely on Dow to supply your Diethyl Malonate requirements.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

PROPERTIES

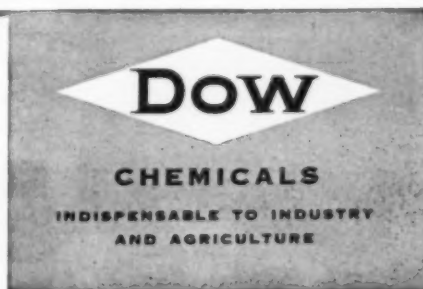
A colorless liquid.

Boiling range at 760 mm. Hg, 5-95%	196-200°C.
Specific gravity at 25/25°C.	1.055
Freezing point	Below -20°C.
Refractive index at 25°	1.412
Flash point	93°C.
Fire point	96°C.

of DIETHYL MALONATE

The Dow Chemical Company
Dept. PH 1
Midland, Michigan

Name _____ Title _____
Company _____
Address _____
City _____ State _____

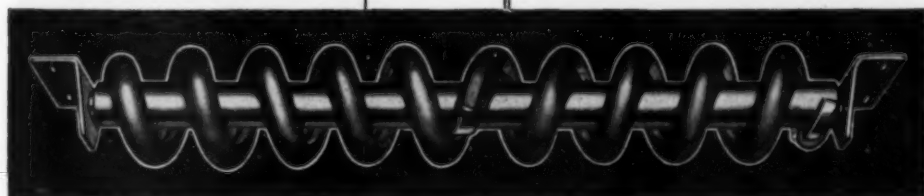


this record proves

THE RETURNS FROM **REX** SPIRAL RETURN IDLERS

COST RECORD (In a large western coke plant)

TYPE OF IDLER	Steel	Rubber Covered Spiral
SERVICE LIFE	3 months	12 months
COST 1st YEAR	\$66.80 for 4	\$47.70 each
SAVING 1st YEAR		\$19.10
Cost of Replacement		
Subsequent Years (per year)	\$66.80 for 4	\$18.20 each (rubber covering)
SAVING per year after 1st YEAR	\$48.60	



Yes, the cost record from *just* this one plant clearly demonstrates the savings possible through the installation of Rex Rubber Covered Spiral Return Idlers.

Before the installation of these cost-cutting idlers, the abrasive action of coke breeze clinging to the return side of the belts wore out the standard steel return idlers in an average 3-month period.

15 Rex Spiral Return Idlers were installed for trial and have given at least 12 months' service—4 times longer than the steel idlers. These idlers provide a constant, ever-changing point of contact between idler and belt, preventing build-up of material on the idler and, in some cases, helping to clean the belt.

Cost records show that the 15 Rex Spiral Return Idlers made possible a saving of \$19.10 per idler and \$286.50 total saving, including initial and installation costs. After the first year, the spiral rubber covering can be replaced, if worn, at a cost of \$18.20 per idler. This cost as compared to \$66.80, the cost of 4 new steel return idler rolls, indicates a saving after the initial year of \$48.60 per year.

Add to these savings, the elimination of down-time

caused by the frequent replacement of steel idler rolls, which makes the cost-cutting advantages of Rex Rubber Covered Spiral Return Idlers even more obvious.

Why not investigate the advantages of Rex Spiral Return Idlers and the other idlers in the Rex Line for your operations? Mail the coupon for your copy of Bulletin No. 463R.



Rex Rubber Covered Spiral Return Idlers installed in this western coke plant delivered 4 times longer service than conventional steel return idlers previously used.



Chain Belt Company 50-214
1648 W. Bruce Street
Milwaukee 4, Wis.

Please send me a copy of Bulletin 463R.

Name.....
Company..... Dept.....
Address.....
City..... State.....

Announcing a New Wide-Range Power Amplifier

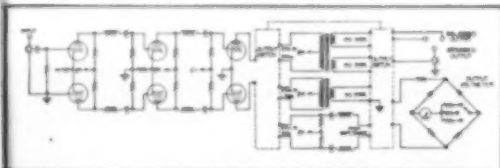
with Substantial Output from 20 Cycles to 3 Megacycles



THE USES for a wide-range aperiodic amplifier in the laboratory are many. A wide range amplifier of considerable output is particularly useful in development and general testing of audio-frequency equipment, and in driving supersonic generators.

The new G-R Type 1233-A Power Amplifier has three output combinations:

20 cycles to 20 kilocycles, into 150 or 600 ohms, balanced or grounded. Output of 15 watts is provided between 50 and 15,000 cycles.



The basic circuit consists of three push-pull broad-band amplifier stages and three output circuits, selected by a switch. Inter-stage couplings are the series-peaked type, designed for constant gain up to 5 Mc. The input stage operates as a phase inverter.

Separate output transformers are used for the 20 cycle to 20 kilocycle and 20 kilocycle to 1.5 megacycle ranges. Both transformers are toroidally wound. Special care was necessary in the design of these trans-

formers to achieve satisfactory performance at the relatively high frequency at which they operate. Both the leakage reactance between the primary and secondary windings and the distributed capacitance of the primary are limiting factors in determining the high-frequency performance.

Polystyrene cups are used as the interwinding insulation to keep the capacitance of the insulation at a minimum.

20 kilocycles to 1.5 megacycles into 50 ohms, grounded. Output 15 watts from 30 kilocycles to 0.5 megacycles; 8 watts at 1.5 megacycles.

20 cycles to 3 megacycles; output 150 volts peak-to-peak, for a high impedance load with a gain of 60 db. With grounded output, voltage is limited to 50, peak-to-peak, with a gain of 54 db.

The 20 cycle to 3 Mc output is intended for use as an oscilloscope deflection amplifier. The maximum output is secured in all cases with an input voltage of 0.2 volt. Distortion is below 3% at maximum output over most of frequency range. Noise is between 60 and 70 db below 15 watts.

The instrument is provided with a diode voltmeter with full-scale ranges of 150, 50 and 15 volts to indicate the output voltage.

The high voltage power supply uses selenium rectifiers in a full-wave voltage-doubling circuit and a two-section LC filter. A bias supply, using selenium rectifiers, provides fixed voltages for the output stage.

This amplifier brings to the development and laboratory technician an instrument of considerable value in that in one instrument a source of audio and r-f amplification of very high gain and very good frequency characteristic is available at considerably less cost than that required to develop and construct an amplifier or a series of amplifiers equal to the performance of this one.

Type 1233-A Power Amplifier\$525.



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Sodium Benzoate
Sodium Sulfhydrate
Sodium Sulfide
Sulfuryl Chloride
Thionyl Chloride

The Hooker Chemicals listed at the left are widely used in the manufacture of pharmaceuticals. As chemical intermediates they are in demand for other uses as well.

Increased demand occasionally makes it impossible to accept new business but we are doing everything possible to keep up with your needs. There has been and will be no compromise with Hooker quality and shipment-to-shipment uniformity.

As materials become available, they are shipped out promptly. Careful scheduling, and point-to-point checking en route, assure that Hooker Chemicals reach you in the same good condition as when they leave us.



IF YOU ARE INTERESTED in the typical properties, specifications and uses of any of these chemicals, we shall be glad to send you technical data sheets. For a complete list of Hooker Chemicals ask for Bulletin 100. Please request on your business letterhead.

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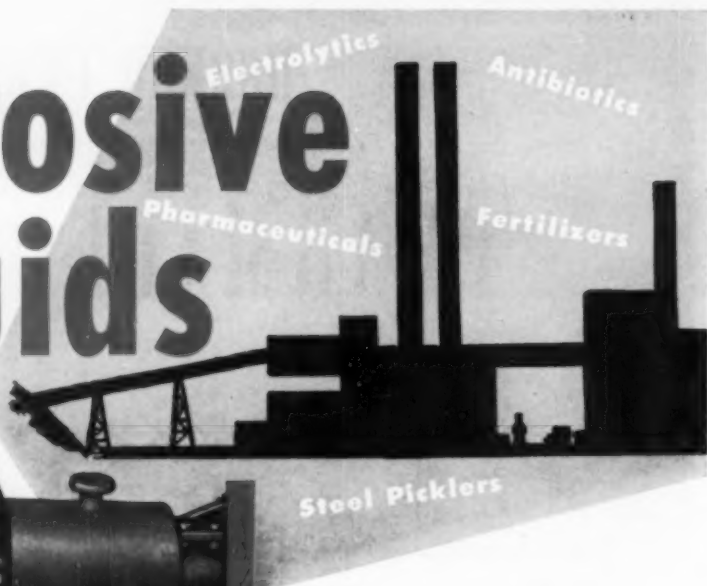
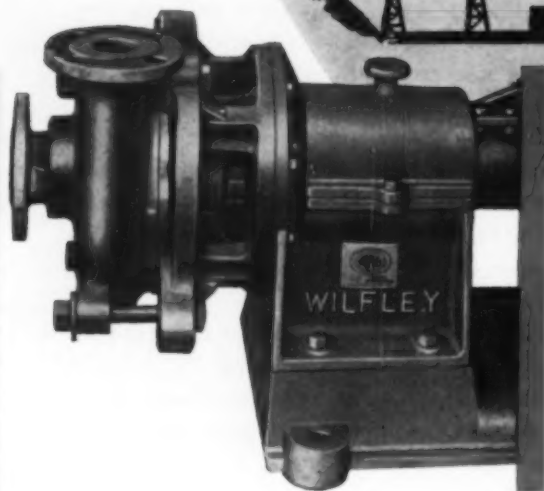
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CHEMICAL ENGINEERING—April 1951

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For corrosive liquids



★ Buy **WILFLEY**
For Cost-Saving Performance

★ Companion to the
famous **WILFLEY**
Sand Pump

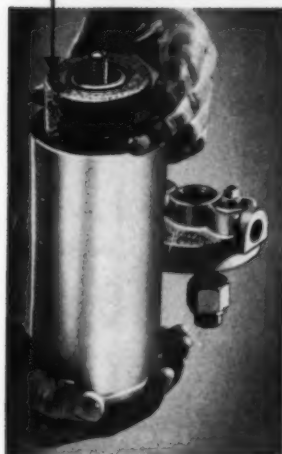
Dependable WILFLEY Acid Pumps handle all corrosive liquids—including electrolytics, antibiotics, pharmaceuticals, fertilizers and steel picklers—efficiently and economically, with no dilution or contamination. In chemical plants all over the world, WILFLEY pumps are on the job delivering trouble-free performance. Actual production-line records prove the **DEPENDABILITY** of WILFLEY Acid Pumps—in stepped-up production and worthwhile power savings.

Famous WILFLEY Acid Pumps are available in 10- to 2,000-G.P.M. capacities; 15- to 150-ft. heads and higher. Wetted parts supplied in machinable alloys or plastic. Individual engineering on every application. Write or wire for details.

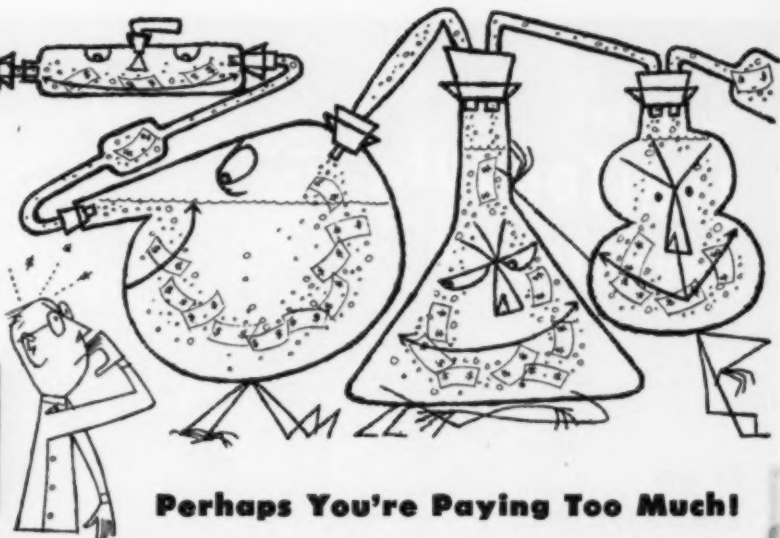
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WILFLEY *Acid* **PUMPS**

**HOW MUCH
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TO YOU...
TO GET
PROCESS FLUIDS
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MICRO-KLEAN cartridges fit other
makes; special lengths available for
built-in installations.



Perhaps You're Paying Too Much!

Sometimes, it's worth a lot. You'll go to any expense to remove contamination.

But—in hundreds of cases, chemi-

cal firms are getting perfectly satisfactory results with the less expensive Cuno MICRO-KLEAN replaceable-cartridge filter.

SO YOU HAVE TO ASK YOURSELF . . .

1. Will the MICRO-KLEAN do my job well enough?

To help you answer: Cuno MICRO-KLEAN is guaranteed to remove all solids larger than specified* plus a large proportion down to 1 micron.

2. How much will the MICRO-KLEAN save me?

Well, the savings come from:

a. Lower initial cost

b. Lower maintenance cost—housing easily disassembled for cleaning—filter renewed by simple replacement of cartridges.

c. Lower replacement cost—MICRO-KLEAN's exclusive construction assures double life.

d. Positive mechanical separation—cartridge cannot shrink, swell, channel, or distort—fluid is protected.

INVESTIGATE MICRO-KLEAN NOW!

This well-proved filter handles wide range of fluids at wide ranges of flow

rates and viscosities . . . capacities from a few to over 800 gpm . . . connections from 1/2 in. IPS to 6 in. flanged.



**Complete Line
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**Removes More Sizes of Solids
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3 to 4 times faster

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A positive, manual declutching lever disengages the motor driven worm gears and permits the handwheel to turn an independent set of bevel gears direct to the valve stem. This assures 3 to 4 times faster

closing than is obtainable with other types of controls whose manual operations are all or in part through the main stem nut gearing. Further, it makes handwheel operation certain even when the motor cannot be turned.

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Wyandotte Mercury Cell Caustic can save you money

Wyandotte Rayon Grade Caustic Soda is purer than most reagent grade caustics. And yet you pay no more for it. But that's just half the story. Because this Wyandotte Caustic is naturally pure. Produced by the Mercury Cell process, it needs no special purifying treatments.

One company we know of used to buy a regular grade of caustic and then they had to purify it. Now they buy Mercury Cell Caustic and pocket substantial savings.

Wyandotte Mercury Cell Caustic is free from sodium chloride, sodium chlorate, iron and practically all other impurities. It is shipped in specially lined tank cars, arrives ready for use without further processing.

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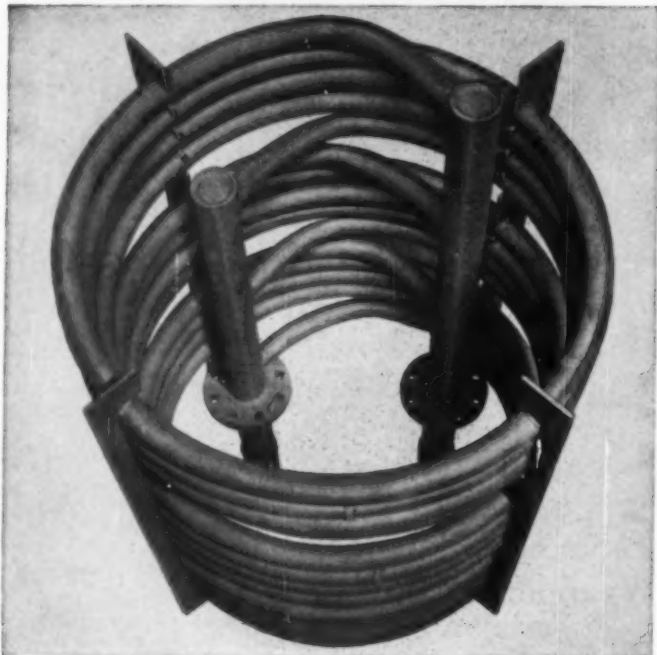


COPPER ALLOY BULLETIN



MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND. — IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

Lead-Copper Duplex Tubes For Heating Sulphuric Acid Solutions



Lead-copper Duplex Tubing heating coil. Courtesy The Patterson-Kelley Company, Inc., East Stroudsburg, Pennsylvania.

One of the most corrosive liquids widely used in industrial processing is sulphuric acid in various concentrations. Aside from lead no other commercial metal can withstand sulphuric acid under a wide range of conditions for any appreciable length of time. This explains why containers for sulphuric acid solutions are usually lead-lined. Steam heating and cooling coils immersed in sulphuric acid solutions are also generally made from lead.

Lead-Copper Duplex Tubes

Installations of coils made from Duplex Tubing, lead outside with copper inside, have shown some important advantages over lead tubing. The stronger, harder inner tube of copper permits the use of higher steam temperatures and pressures than are prac-

tical with the softer and weaker lead tubing. Thus the usable range of temperature and pressure is increased substantially. Furthermore, copper withstands the effects of corrosive steam better than lead.

Lead-copper Duplex Tubing may be used at steam pressures up to 150 lbs. per square inch at 360° F., whereas lead tubing is limited to a maximum of about 50 lbs. steam pressure at 300° F.

Corrosion resistance of lead is generally excellent in sulphuric acid solutions containing up to 50% acid. Lead is also resistant to sulphurous, phosphoric and chromic acids, all of which can be heated or cooled by immersion in lead-copper Duplex heating coils. Lead is also satisfactory for resisting corrosion from wet or dry sulphur di-

oxide and sulphur trioxide.

The thickness of the lead component of lead-copper Duplex Tubing is usually $\frac{1}{8}$ " or more depending upon the severity of the requirements.

Duplex Tubing can be made of several grades of lead, to meet A. S. T. M. specifications. Through the use of high purity lead, maximum corrosion resistance can be obtained. The high purity leads (chemical) are useful up to about 400° F. Antimonial leads, because of their lower melting points, are limited to a maximum of about 250° F.

Joining Duplex Tubes

In making heating coils from Duplex Tubing, it may be necessary to join two or more lengths to obtain the required sizes of coils. Joints are made by cutting back the outer lead component about $\frac{1}{2}$ " from each end of the Duplex tubes to be connected. The copper inner tube from one end is expanded by driving in a plug of the proper size so that the expanded end becomes large enough to receive the copper inner tube of the other Duplex tube. The joint is secured by soldering. A thick overlay of lead is wiped on to cover the exposed copper.

After prolonged service, lead-copper Duplex Tubing coils possess excellent heating transfer characteristics and exhibit superior corrosion resistance.



Bridgeport Duplex Tube—lead outside and copper inside.

There are, of course, many other processing applications for lead-copper Duplex Tubing than for heating and cooling sulphuric acid. Information on various components of metals used in Duplex Tubing, as well as the variety of applications, are published in Bridgeport's "Duplex Tubing Technical Bulletin No. 1950", which will be mailed upon requests made on company stationery. (6542)



*Let's take a look
at the record!*



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BS&B's records make up quite a library of SAFETY HEAD applications and users. Through the years, their accuracy and completeness save time, eliminate confusion and error.

It's another example of BS&B thoroughness in the exclusive manufacture of these versatile pressure relief devices. No other relief device acts so quickly. The SAFETY HEAD absorbs the shock of overpressure...provides a fully open, pipe-size opening after disc rupture. Eliminates injuries, equipment loss. Avoids costly shut-downs. Tamper-proof, fool-proof SAFETY HEADS are a must if you have equipment under pressure!

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for
Positive Pressure Protection



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PROMPT DELIVERY

You get extra protection from these rugged, all wood carboy boxes due to their sturdy, patented construction . . . with interchangeable cork (Hercules) or rubber cushion (Aero) inserts and cushions. That's why they stand up under the rough-and-tumble of regular usage and save you both time and money by reducing bottle breakage, repairs and replacements. For the best carboy boxes possible . . . contact National!

6½-GALLON CARBOY FEATURES

Built to withstand an internal pressure of 10 lbs. this completely enclosed wooden carboy, with interchangeable cork or rubber cushion inserts and cushions, complies with I.C.C. 1-D regulations for the transportation of mineral acids. Specific application should be made for other uses.

1. Flat cover—no protruding neck—enables boxes to be piled on top of each other for convenient, compact storage.
2. Corner posts provide a convenient handle so that one man can handle the carboy.
3. Small size and light weight provides for easier handling and shipping.
4. Regulation Polystyrene cap supplied.

Complies with
classification I.C.C. 1-D



For Information write to Dept. E



13-GALLON CARBOY FEATURES

1. All-point protection reduces bottle breakage to a minimum—both in loading and transit.
2. Reduces occupational hazards since safety from breakage minimizes danger of acid burns or fire.
3. Eliminates foreign filler materials from container.
4. Easy to handle, through good grip on side hand braces.
5. Compact loading, resulting in space saving storage.
6. No skilled labor or special tools required. Any man can handle it quickly and efficiently.
7. Also available in 5 gallon and other capacities.

Complies with classification
I.C.C. 1-A

NATIONAL BOX & LUMBER COMPANY
NEWARK 5, NEW JERSEY





FLEXIBLE AS A ROPE

Condor **HOMOFLEX HOSE**

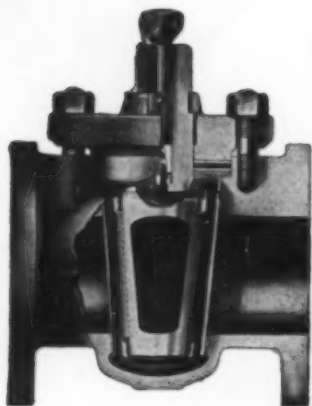
"Why, this hose is flexible as a rope!" say the men who work with it. • But it's no surprise to us—we engineered it that way. Homoflex has no pre-set twist, it coils and uncoils easily. It doesn't kink or collapse on sharp bends. It's light, but amply strong. It's easy to handle. It's sized uniformly. Workmen like it . . . It lasts longer. • How these advantages are built into Homoflex is in Bulletin 6879 D, mailed on request. • The same engineering goes into our V-belts, flat belting and conveyor belts. Just phone your R/M Distributor.



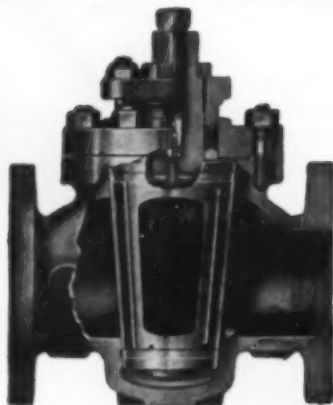
MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

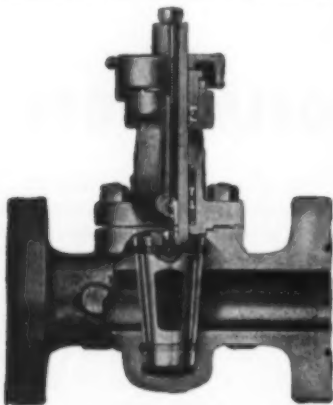
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Single Gland Type



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Walworth Lubricated Plug Valves are available in sizes $\frac{1}{2}$ " to 24" for pressures from 125 to 5,000 psi, and for vacuum requirement. For further information about Walworth's Complete Line of Lubricated Plug Valves, see your Walworth distributor or write for Circular No. 111.

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As originators of the Snubbing Principle to reduce noises from engine exhausts and compressor intakes and a pioneer in surge control in gas and air piping, we are capably qualified by a quarter century of broad experience to serve you. Continuous, intensive research to improve the design of our Snubbers and diligent study of thousands of Burgess-Manning Snubber applications has kept us abreast of the tough, new operating problems in engine and compressor noise restriction and surge control confronting the petroleum industry. Consult Burgess-Manning, today: Sound engineering counsel, reliable Snubber design, a product manufactured to exacting specifications, guaranteed Snubber performance. Write for literature.

BURGESS-MANNING COMPANY

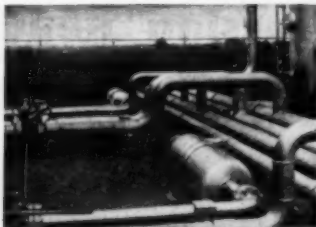
749 East Park Avenue, Libertyville, Illinois



FLUID CATALYTIC UNIT—A large size Burgess-Manning Snubber installed on flue gas blow off from regenerator on fluid catalytic unit of a Texas petroleum corporation.



SURGE CONTROL—Gas and Air Line Snubbers installed on the discharge of the first and high stage of a compressor.



GAS BOOSTER STATION—Burgess-Manning Snubbers installed in the high pressure discharge lines in a gas booster station.



GASOLINE PLANT—Burgess-Manning Exhaust Snubbers installed on 600 hp engines in an Oklahoma gasoline plant.

From well head through the refinery gate

INSTALLATIONS

- Stationary and portable internal combustion engines
- Steam discharge
- Positive displacement and reciprocation vacuum pump discharge
- Compressors, blowers

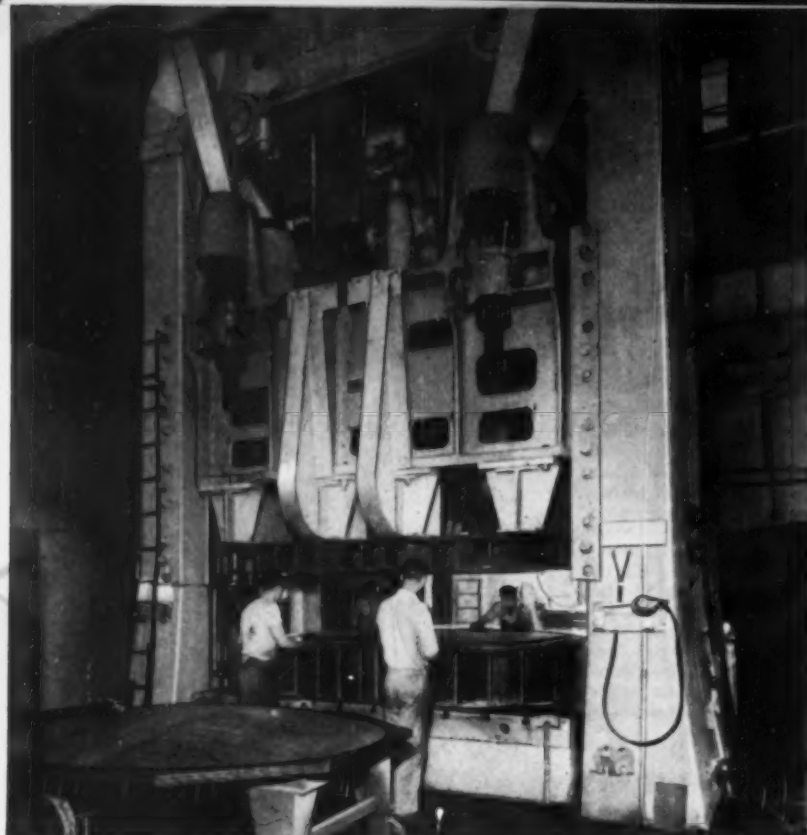
PETROLEUM APPLICATIONS

Oil and gas production • oil and gas well repressuring and recycling • gas transmission • gas distribution • natural gasoline industry • manufactured gas industry • petroleum refining • petrochemical process industry • drilling • oil well pumping • crude oil and product pipe lines • chemical industry • all industries handling air, steam, refrigerants.



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For prompt service contact our
New Engineering and Sales Office
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Answer to a "Pressing" need...

TROUBLE-FREE hydraulic operation of a new toggle press was particularly important to the Brown Steel Tank Company of Minneapolis. Such operation would keep costly inspections of the hydraulic unit at a minimum—production at a maximum.

A Standard Oil lubrication specialist was called in. He recommended STANOIL Industrial Oil for this vital hydraulic job. During three years of hard, continuous service (hydraulic unit operates 2000 P.S.I. maximum), STANOIL has stayed on the job and has permitted efficient hydraulic operation. It has not been necessary to inspect the hydraulic unit in all of this time. A recent sample test showed the hydraulic oil to be in excellent condition.

STANOIL will give long oil life and trouble-free service in a wide variety of equipment: speed reducers, head stock gears, auxiliary turbines, compressors, as well as hydraulic sys-



tems. STANOIL is fortified to combat rust and corrosion.

Your nearby Standard Oil lubrication specialist is ready to explain how your plant may obtain maximum benefits from STANOIL and other high-quality petroleum products.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for his prompt attention.

What's YOUR problem?



Meet C. K. Olson, lubrication specialist in Standard Oil's Minneapolis office.

Consulted by the Brown Steel Tank Company, he recommended STANOIL Industrial Oil as the answer to their needs. As a result, he helped the company realize significant savings in operating costs.

Standard Oil lubrication specialists are located throughout the Midwest. Just phone or address a card to the nearest Standard Oil Company (Indiana) office for the services of the specially trained lubrication specialist near your plant.

With his help, find out how many different oils in your plant can be replaced by STANOIL Industrial Oil on such applications as:

Air compressors . . . no sticking or clogging of valves, less oil consumption in splash or circulating systems.

Speed reducers . . . less wear of gears and bearings during frequent cold starts or prolonged high-temperature operation.


Steam turbines . . . freedom from emulsions and sludge, fewer oil changes necessary.

Ring-oiled bearings . . . rings function immediately on starting, less bearing wear.


Circulating and bath systems . . . one oil for a wide variety of jobs.



STANDARD OIL COMPANY (INDIANA)




Bailey Electronic Instruments Work Here at the Lake Charles, La. plant of the Mathieson Chemical Corp.




Bailey Electronic Instruments Work Here at the Kodak Park plant of Eastman Kodak Co., Rochester, N.Y.

alkali OR FILMS



Bailey Electronic Instruments Work Here at the Chillicothe, Ohio Mill of the Mead Corporation.



Bailey Electronic Instruments Work Here at the Midland, Michigan plant of The Dow Chemical Company.

paper OR CHEMICALS

★ No matter what you process it will pay you to check into the Bailey simplified electronic control system.

With four basic circuits and eight basic component parts you can get more than 100,000 different electronic instrument and control combinations. Your problems of measuring and controlling flow, level, speed, pressure temperature, gas analysis, pH, conductivity, etc., can be solved by the right combinations of these 4 circuits and 8 basic parts.

You don't have to load up a stock room with parts. Bailey parts are interchangeable. What you used for the last combination is good for the next one when conditions in your plant change. You can save money, as others are doing, when you standardize on Bailey controls.

Bulletin No. 17 will show you how easy it is to install and use Bailey electronic controls. Write for your copy today.

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TEMPERATURE • FLOW • PRESSURE
GAS ANALYSIS • LEVEL • RATIO

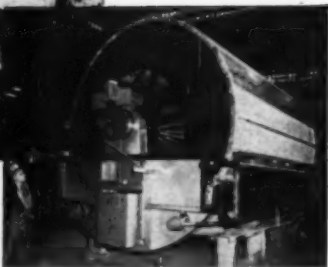


What's U.S. Rubber doing with Plastic Pipe?

Giving it extremely high impact strength, for one thing. A single .44 cal. revolver bullet, fired at a distance of 20 yards, merely dented this piece of pipe, which is made of U.S. Rubber's new plastic, Uscolite. This amazingly strong, lightweight, versatile piping is easy to handle, won't break if dropped. Furnished in standard lengths, it can be cut to length and threaded on the job. Uscolite is resistant to most chemicals. For more information, write to address below. In Canada, write to the Dominion Rubber Company.



U.S. ROYAL MEAT CUTTING TABLE TOP made of Uscolite stands up longer than wood. U.S. Royal tops retain their shape, are easier to clean.



THIS CONKEY FILTER, part of the sanitation system of a midwestern city, is equipped with Uscolite piping. Uscolite handles corrosive acids, alkalis, salts.

PRODUCT OF

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SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY
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If it's a gas that can be handled ...WORTHINGTON COMPRESSORS *Handle it Better!*

Keeping pace with the chemical industries' rapid progress, Worthington builds compressors for the widest range of gases. More than that, Worthington maintains a staff of specialists whose sole job is to know — or to find out — the answers to all problems concerning gas compression.

That is why your own applications in this field can be best served by Worthington... with compressors that will perform more efficiently and economically over a longer service life. Why not get the whole story that proves *there's more worth in Worthington?* Write, describing your requirements, to Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.

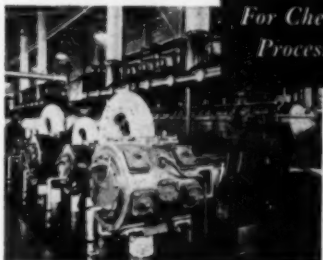


Steam Driven Compressors in a Synthetic Glycerine Plant.



Steam Driven High Pressure Circulators in a Nitrogen Fixation Plant.

*Typical
Worthington
Compressor
Installations
For Chemical
Processing*



Angle Gas Engine Driven Compressors in a Gas Oxidation Plant.



Motor Driven Multi-Stage Compressors, used in Liquefaction of Air.

Partial List Of Gases Handled By Worthington Compressors

Butane • Propane • Butadiene • Carbon Monoxide • Carbon Dioxide • Acetone Benzole Mixture
Sulphur Hexafluoride • Coke Oven Gas • Ethylene • Ethylene Dichloride • Furfural • Hydrogen
Hydrogen Chloride • Hydrogen Sulphide • Methyl Chloride • Methyl Ethyl Ketone • Nitrous Oxide
Oxygen • Sulphur Dioxide • Vinyl Chloride • Ethylene Oxide

WORTHINGTON



**NO OTHER
COMPRESSOR
WILL
OUTPERFORM
A
WORTHINGTON**



Y-types



Balanced Angle Compressors



Horizontal



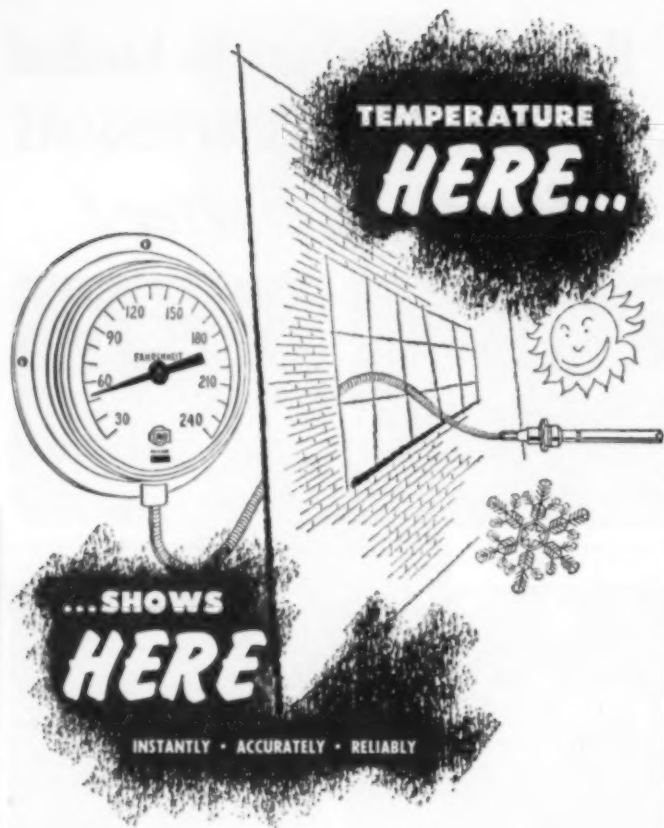
Portable



Radial



Gas Engine Compressors



TAG DIAL-INDICATING THERMOMETERS

Around corners . . . through walls . . . from one floor to another—TAGIabue Dial Thermometers indicate true temperatures year in, year out. Needing no connection to any power supply, these sturdy instruments give readings as remote as 250 feet through temperature-compensated capillaries. Ranges extend from -300°F . to $+1000^{\circ}\text{F}$. Accuracy is unaffected by vibration or severe shock.

Use these versatile TAG Thermometers for marine, power plant, refrigeration system or heating equipment applications—in fact, *wherever* you need to know temperatures immediately, accurately, dependably. Be sure you have full information on file.



TAGLIABUE INSTRUMENTS DIVISION

Weston Electrical Instrument Corporation

614 Frelinghuysen Avenue, Newark 5, New Jersey



"TAG" Temperature Recorders Chart from -300° to $+1000^{\circ}\text{F}$.

Accurate written records of varying temperatures are charted by the Temperature Recorders produced by TAGIabue Instruments Div., Dept. 67, Weston Electrical Instrument Corp., Newark 5, N. J. Temperatures as low as -300°F . or as high as $+1000^{\circ}\text{F}$. can be recorded with these versatile instruments.

Various types of actuations in TAG Temperature Recorders achieve scale expansion for utmost precision over the working ranges. Interchangeable tube systems are laboratory calibrated at the factory. A safety link provides over-range protection. Details are given in Catalog 1210.



Self-Operating Controllers Hold Precise Temperatures

Temperatures between the limits of 20 and 300°F . are accurately maintained by the line of Self-Operating Controllers manufactured by TAGIabue Instruments Div., Dept. 67, Weston Electrical Instrument Corp., Newark 5, N. J. These controllers are entirely self-contained, requiring no connection to any air or electrical power supply.

Available in styles for use on steam, hot water or refrigerant lines, TAG Self-Operating Controllers continuously adjust the supply of heating or cooling medium to maintain constant temperature despite changing thermal conditions. Typical applications include water heaters, tanks, retorts, washers, driers and pasteurizers.



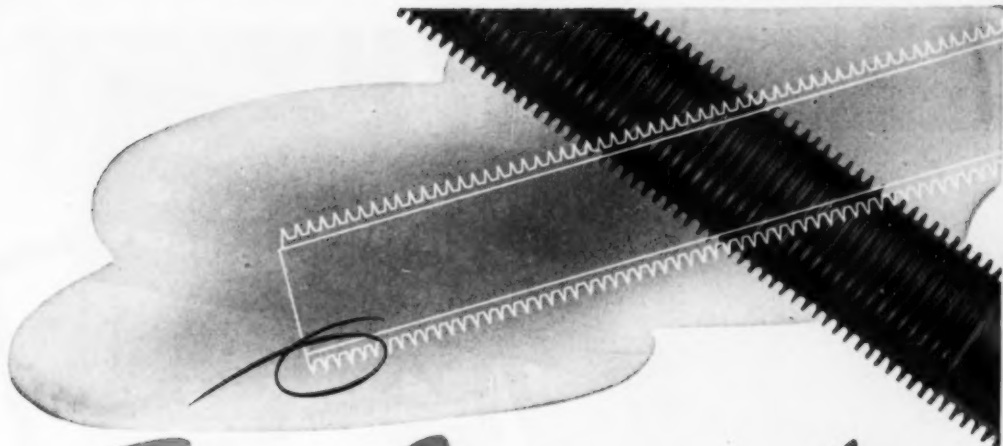
"Thermicator" Thermometer Used With or Without Case

Convenience is outstanding in the new "Thermicator" pocket-type thermometer introduced by TAGIabue Instruments Div., Dept. 67, Weston Electrical Instrument Corp., Newark 5, N. J. This simplified instrument can be used as either an armored or a plain thermometer.



The "Thermicator" consists of an etched-stem glass thermometer and its non-corroding protective case. Slimmer than most fountain pens, it is secured in any depth pocket by an adjustable clip. There is no cap to unscrew; the thermometer is held in the case by spring pressure and is whisked free or replaced in a single motion.

The "Thermicator" is 6" long, $\frac{3}{8}$ " in diameter, and is graduated in 2° divisions. Ranges are -30 to $+120^{\circ}\text{F}$. (spirit-filled) and 0 to $+220^{\circ}\text{F}$. (mercury-filled). Entire bore is visible.



Fins Integral are important

By providing more surface area in the same tube length, Wolverine Trufin* condenser tubes help to conserve tubing. You use less compared to plain surface condenser tubes.

The increased surface area of Wolverine Trufin also permits more economy in producing most petroleum condensates.

With the fins integral with tube itself Trufin condenser tubes can withstand vibration, they can be easily cleaned and the tube lasts longer. Retubing and "shut down" time is reduced appreciably.

In these days when the conservation of men, metal and machines is vital, Trufin condenser tubes can reflect both improved efficiency and economy. Would you like our Technical Bulletins describing this unique finned tube? Ask for them on your company stationery.

*Reg. U.S. Pat. Off.

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Calumet & Hecla Consolidated Copper Company

INCORPORATED

Manufacturers of seamless, non-ferrous tubing

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Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ont.

Wolverine condenser tubes stocked by Butler Industries, Inc.,
355 So. Fourth St., Beaumont, Texas Telephone Beaumont 5-2351



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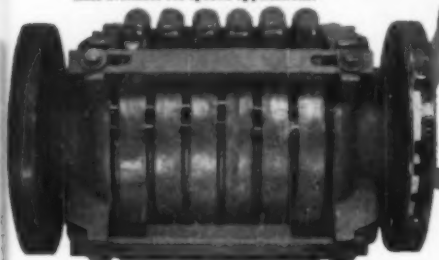
Sales Offices in Principal Cities

Export Department, 19 E. 40th St., New York 16, N. Y.

HERE'S WHY



CMH Free-Flexing Expansion Joints for pressures to 30 psi; stainless steel or copper; flanges or welding ends; standard sizes to 30" I.D.; larger sizes available for special applications.



CMH Controlled Flexing Expansion Joints for pressures to 300 psi; stainless steel or copper; flanges or welding ends; sizes to 30" I.D.



CMH Flexoniflex Expansion Joints with integral control rings for pressures to 1500 psi; stainless steel and other alloys; standard sizes $\frac{3}{8}$ " through 6" I.D.; larger sizes also available.

Flexon identifies CMH products that have served industry for over 48 years.



CMH Expansion Joints
are preferred by so
many piping engineers

- ✓ Space Saving
- ✓ Weight Saving
- ✓ Streamlined Flow
- ✓ Lower Overall Cost
- ✓ Ease of Installation
- ✓ Trouble Free Operation
- ✓ Freedom from Maintenance

THE PROBLEMS of pipe motion control are reduced to a minimum when you use CMH corrugated type expansion joints. Scientifically formed by advanced methods, they represent the modern, cost-saving, trouble-saving way to control axial, lateral or radial motion in piping or to correct for misalignment.

For new installations or for replacement of obsolete equipment, specify CMH expansion joints. Complete data is given in CMH's Expansion Joint Design Guide. Write for a copy . . . it's the first step towards eliminating the headaches that are so often a part of pipe-line motion control. See our Catalog in Sweets.

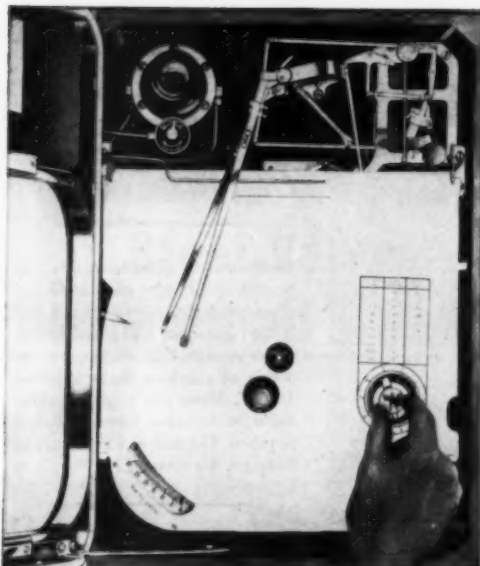
CHICAGO METAL HOSE Corporation

1317 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

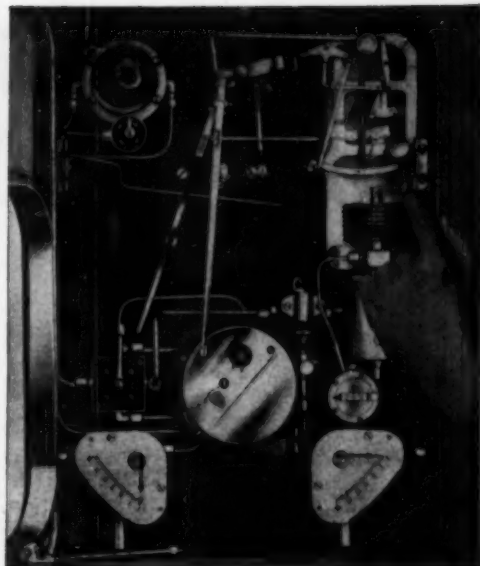
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ONE DEPENDABLE SOURCE
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Convuluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components



EASIEST TO PUT INTO OPERATION—Calibrated control actions save hours of shutdown. Reset, derivative and proportional values can be exactly reproduced at any time on the same or any other Series 500 controller . . . merely by duplicating the setting. Thus: controller adjustments can be standardized for any process throughout a plant or national organization.



EASIEST TO SERVICE—Inherently simple design, using the fewest possible parts, plus extremely close-tolerance manufacturing . . . make the instrument thoroughly interchangeable, trouble-free and a cinch to service. For example: only one simple adjustment puts the system in exact calibration even after complete disassembly and reassembly.

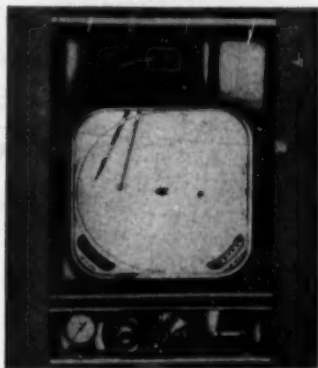
ONLY BRISTOL SERIES 500 CONTROLLERS GIVE YOU THIS EASE OF OPERATION

When you wish to reproduce a previous control action or duplicate one taking place at some other point, the Bristol Series 500 Air-Operated Controller permits you to do it merely by setting a dial.

Or, should the instrument require servicing, only one simple adjustment is needed to calibrate the control system and put it back in operation. Almost anyone can service this instrument.

Furthermore, users report that the Bristol Series 500 Controller requires practically no maintenance.

This outstanding instrument—a product of 60 years of experience—is completely described in Bulletin A120. THE BRISTOL COMPANY, 109 Bristol Road, Waterbury 20, Conn.



BRISTOL SERIES 500 CONTROLLERS are offered in five types—on-off, proportional, reset, derivative, reset plus derivative—to control temperature, flow, pressure, liquid level, humidity, pH. Conversion from one type to another can be made by the user. Model shown has external-manual station with mechanical interlock for test and service.



BRISTOL

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

CHEMICAL ENGINEERING—April 1951

309

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Briefs

From recent literature

Sterilization of dried foodstuffs may be accomplished by using undiluted ethylene oxide. Materials are preheated to about 220° to 240° F. under vacuum, then subjected to the action of ethylene oxide at about 150° F. About one pound ethylene oxide to 35 cubic feet of space is required. Original characteristics of materials are retained.

Corrosion inhibiting coatings on ferrous metal surfaces can be provided by pretreatment in an aqueous solution employing a dispersing agent made from the reaction of 29 to 90 mols of ethylene oxide with 1 mol of lauryl alcohol.

N-methyldiethanolamine has been prepared, without serious contamination by higher homologues, by reacting gaseous ethylene oxide at a temperature of about 80° C. with an aqueous solution of methylamine. Yields of 83% based upon ethylene oxide have been reported.

Surface active agents of the glycol thioether type can be prepared with less by-product formation and improved yields by a two-step condensation of mercaptans containing from 6 to 24 carbon atoms with ethylene oxide. Initial condensation is carried out below 75° C. and further condensation in the range of 85° to 150° C.

Products made by this method are said to have greater uniformity of chemical constitution and physical state.

These developments are abstracted from recent publications or U. S. patents. The uses may suggest other applications of Jefferson Ethylene Oxide in your products or processes.

CHAPMAN

Steel Valves

Score on all 3 Points

2

CHAPMAN STEEL VALVES are made exclusively from quality-controlled steels developed and produced in Chapman's own foundries under control of Chapman's own outstanding metallurgists.

1

CHAPMAN STEEL VALVES have the high precision ratings of custom-made valves — but the economy of production-line manufacture.

3

CHAPMAN STEEL VALVES are designed to equal or surpass — A.S.A. and A.P.I. Standards in all pressures and temperature ranges.

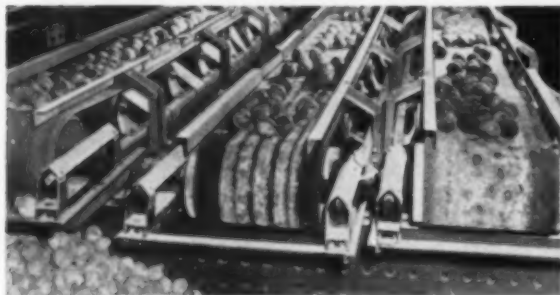


Be sure to see Chapman first whenever you need steel valves — gate, globe, angle or check. As a result of Chapman's long years of research and experience, they are tops in every respect.



The Chapman Valve
MANUFACTURING COMPANY
INDIAN ORCHARD, MASS.

LINK-BELT engineering experience...



Link-Belt Flat Belt Conveyors transferring balls of water treatment compound from presses to storage bins.



Convenient Link-Belt drop spouts discharge silica sand from silos to troughed belt conveyor for delivery to grinding mill.

LINK-BELT quality components...

<p>Standard for industry—L-8 "100" Idler</p>	<p>Grease-in-Dirt-out seal Large grease reservoir prolongs lubrication intervals Precision roller bearings maintain alignment Full length central tube and roll shell are continuously welded to dished steel heads for uniform, perfectly balanced strength</p> <p>Less lubrication and adjustment</p>	<p>No springs, no loose parts, no sliding metal-to-metal contact Foreign matter can't penetrate labyrinth — lubricant preserved</p> <p>Grease-in-Dirt-out Seal</p>
--	---	--

add up to your best bet in BELT CONVEYORS

LINK-BELT Belt Conveyors provide dependable, efficient travel for many different materials

Get the finest in belt conveyor equipment in your plant. It can be as simple as calling in a Link-Belt engineer while you're still in the planning stage.

Thousands agree Link-Belt builds the finest belt conveyors on the market today. More, it has the most complete line of components—all types and sizes—idlers, take-ups, pulleys,

trippers, bearings and power transmission drives. Plus all related equipment—other types of conveyors, feeders, elevators, car dumpers and shakers, weigh larries.

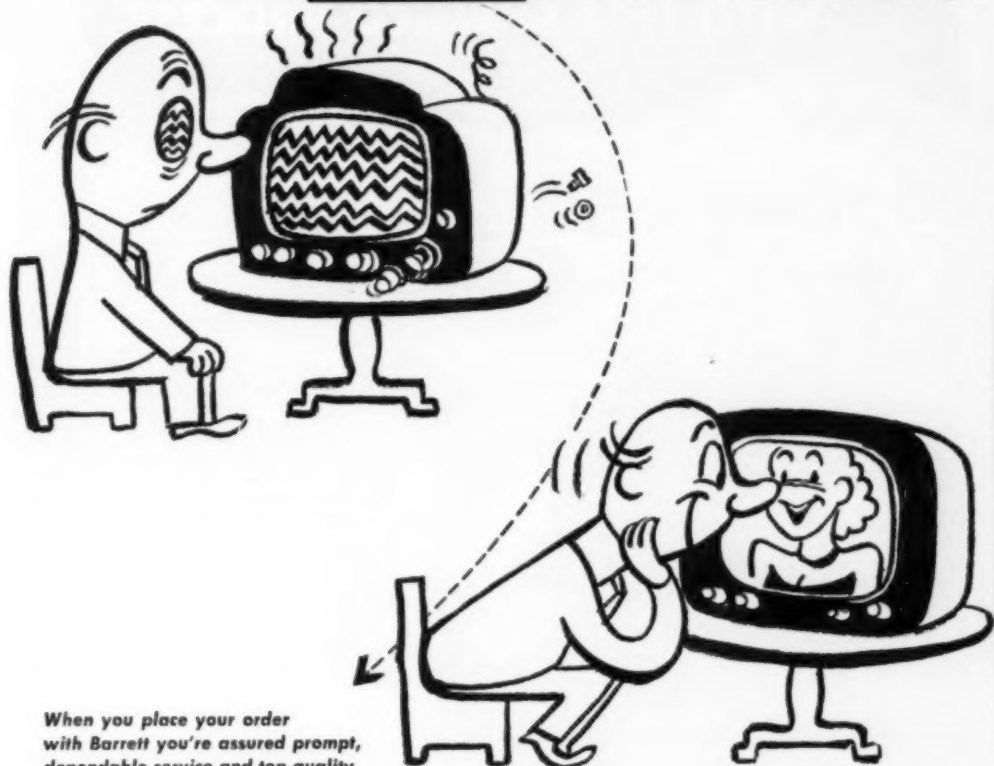
Equally important, Link-Belt Belt Conveyor engineers can draw on the broadest material handling experience in industry. They'll work with you and your consultants—help you come up with the right system for your requirements.

Call or write the Link-Belt branch office nearest you for the services of a belt conveyor expert.



LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in Principal Cities. 12,346-0

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Xylol	Pyridines	
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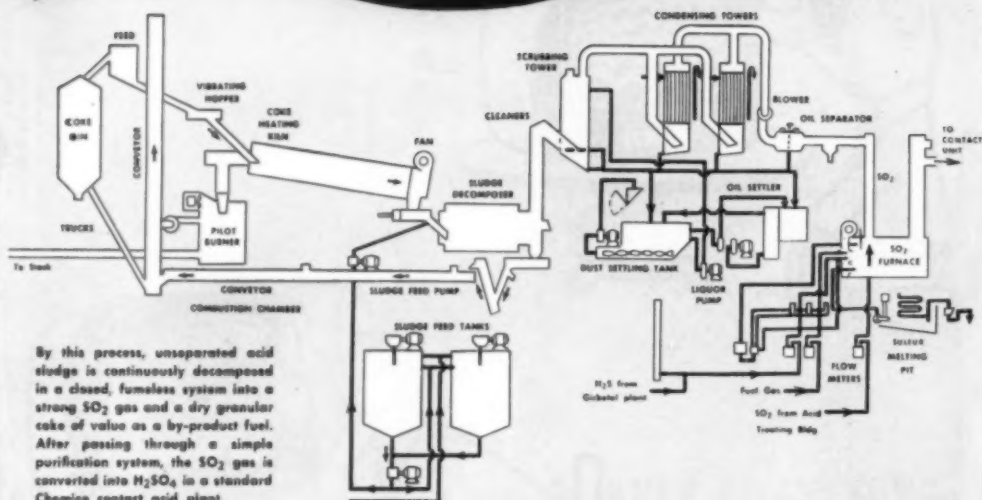


THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

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Make Sulfuric Acid from Refinery Sludge

WITH THIS CHEMICO PROCESS



With the increasing shortage of raw sulfur, industry is turning to other materials which can be used for making much-needed sulfuric acid. An important source—waste oil refinery sludge—can be converted into clean sulfuric acid of any desired strength by the Chemico process shown in the flow diagram.

This proved and practical process offers three important advantages. (1) The purified SO_2 gas provides a product acid that is free of carbon contamination. (2) The resulting H_2SO_4 may be 98% or any higher strength regardless of the initial strength of the sludge. (3) Sludges that cannot be processed by other methods may be satisfactorily used in this system.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

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EUROPEAN TECHNICAL REPRESENTATIVE: CYANAMID PRODUCTS, LTD., LONDON W. C. 2, ENGLAND
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Assured results with CONKEY INTEGRAL EVAPORATOR...savings in first cost...continuing savings in operating costs

FIRST COST SAVINGS start when the Conkey Integral Evaporator is delivered to your plant. Shipped completely assembled, a single up-ending operation sets it in place. A minimum of space is needed because of its vertical design. And its integral construction saves additional space—no external centrifugal type separators, no outside flash tanks or piping are needed. Structural supports are eliminated, too. Foundation is a simple slab. In mild climates, outdoor installations are practical. Only pumps and instruments need weather protection.

CONTINUING SAVINGS RESULT with Conkey design because it reduces pressure drop losses between effects and provides increased working temperature drop across the heating element surface. Result: a net positive gain in evaporation, extra evaporating capacity for the same heating surface under the same working conditions.

TO FIT SPECIFIC PROBLEMS, evaporator can be built with fusion welded construction in steel plate and also with all weldable metal and alloys. Design also permits construction to meet ASME and API-ASME codes for high pressure operation. Write for all the facts.

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to do
your job
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Turbo-Mixers, Filters, Thickeners,
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Sales Offices: 10 East 49th Street, New York 17, N. Y.
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EXTRA LONG LIFE

— Because of Quality Construction

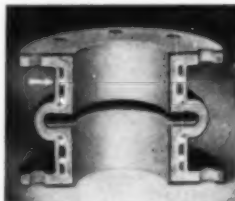
GARLOCK Rubber Expansion Joints are made of a high-grade rubber compound specially developed by Garlock for long, economical service on pipe lines and other equipment. Furnished in three styles: No. 204 for *Pressure*, No. 205 for *Vacuum*, and No. 206 for *Pressure and Vacuum*. Available in neoprene construction for oil service.

8 Superior Features:

1. Made of high-grade rubber, they do not crack or fracture under repeated flexing.
2. They do not take a permanent set.
3. For pressures from 40 to 125 p.s.i.; and for vacuum of 30 in. of mercury.
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5. They do not corrode or erode.
6. They are light in weight and can be installed in a limited space.
7. They require no gaskets between the flanges of the joint and the flanges of the pipe.
8. They do not induce electrolysis.



Garlock "multiple arch" Rubber Expansion Joint.



Arrow points to one of steel reinforcing rings in single arch joint.



Garlock expansion joints are furnished in all pipe sizes from 2" to 72".



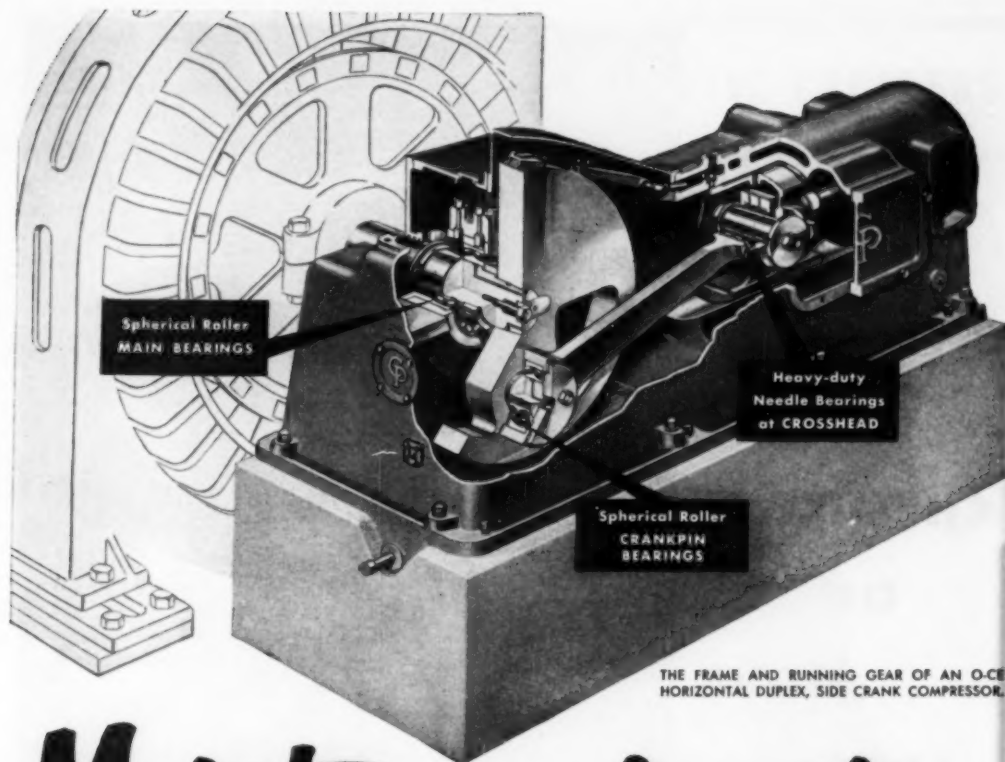
Write for Folder:

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company
of Canada Ltd., Montreal, Que.

GARLOCK

**RUBBER
EXPANSION
JOINTS**



THE FRAME AND RUNNING GEAR OF AN O-CE HORIZONTAL DUPLEX, SIDE CRANK COMPRESSOR.

Maintenance is easier

on Class O-CE Air Compressors, because they now have anti-friction roller bearings throughout. They are the first horizontal duplex, side crank compressors to have spherical roller main and crankpin bearings, and heavy-duty needle bearings at the crosshead pins.

The use of roller bearings in the running gear eliminates all danger of misadjustment in maintenance. Roller crankpin bearings permit the use of solid-end connecting rods, the strongest and safest type.

Chicago Pneumatic was able to make this revolutionary innovation, thanks to the recently developed oil injection method of bearing and crank disc installation and removal. This simple method, requiring only a hand-operated oil pump and ordinary hand tools, also greatly reduces maintenance costs.

Class O-CE Motor-driven Compressors are furnished in sizes up to 2000 h.p.

Write for Bulletin 726-5



CLASS O-CE HORIZONTAL DUPLEX COMPRESSOR

A Complete Line

CP Compressors range from 7½ to 2000 h.p., in electric and steam-driven types, pressures to 5000 lbs.; vertical and horizontal models; CP Vacuum Pumps from 7½ to 1000 h.p.



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Around Corners—



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Protection during handling for an ingredient used in a weed killer compound required conveying equipment that would prevent loss by spillage and keep the material free from outside contamination.

S-A engineers were able to recommend and furnish conveying equipment designed to fully meet the users requirements and operate at the lowest cost per ton of material handled . . . a task which for 50 years has been the S-A engineers full time occupation.

Each handling problem calls for special attention to insure a conveying system that will serve most efficiently at lowest cost. S-A engineers are backed by long experience and a complete line of manufactured equipment units. Consult with S-A on your next bulk handling problem . . . you are under no obligation by doing so.

REDLER HORIZONTAL, CLOSED CIRCUIT CONVEYORS

The REDLER horizontal closed-circuit conveyor shown above is part of a handling system for moving chemicals from storage to processing. Sealed REDLER casing construction and dust-tight gates safeguard materials, keep them on the move at 6 TPH and prevent overflows or clogging. Compact REDLER design permits installation around existing columns and beams. Closed-circuit feature allows material not immediately drawn off at discharge to be recirculated until needed.



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DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

STURTEVANT ROTARY FINE CRUSHERS

**Crush or
Granulate
to Fine, Even
Sizes without
Excess Dust...**



Cross section view illustrating the crushing action

These rugged crushers speed output of fines, cut reduction costs. Desired fineness is quickly obtained by regulating hand wheel. "Open-door" accessibility permits fast, easy cleaning. They crush fine . . . crush fast and do not clog. Available in output capacities from 1 to 30 tons-per-hour. Write for catalog.

STURTEVANT MILL COMPANY

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SULPHUR

***Interesting Facts Concerning This Basic
Raw Material from the Gulf Coast Region**

***MINING**



The process of mining sulphur, as developed by Herman Frasch, takes advantage of the fairly low melting point of sulphur (about 240° Fahrenheit). The process resolves itself into three parts: one, operating a power plant that heats and pumps to the field large quantities of water; two, distributing the hot water through wells to melt the underground sulphur, and raising the melted sulphur to the surface; three, cooling and solidifying the sulphur in large vats from which it is broken and loaded into cars for shipment.

The power plant and water reservoir, as well as the vats and permanent structures, are placed at some distance from the sulphur deposit to avoid possibility of damage from surface subsidence, resulting from extraction of the underground sulphur.

Loading operations at our
Newgulf, Texas' mine



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75 East 45th St. New York 17, N. Y.
Mines: Newgulf and Moss Bluff, Texas



Up-to-the-minute data on pressure vessel outlets

IN THIS new Pressure Vessel Catalog 501 you will find the latest data covering pressure vessel outlets compiled as you would expect it to be by the originators of forged and rolled steel welding necks and nozzles.

The pages include up-to-the-minute information on seamless steel nozzles, welding necks, manways, and large diameter flanges for boilers, heat exchangers, and other pressure vessels. Of particularly timely importance

are data covering standards of Tubular Exchangers Manufacturers Association (TEMA Standards). A useful section on modern flange design covers codes, materials, and design procedures with typical calculation forms and examples of calculation.

This 118 page book is available without charge to anyone having a specific interest in outlets for pressure vessels. To obtain your copy see your Taylor Forge Distributor or **MAIL THE COUPON.**



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HIEROGLYPHICS... *with a modern meaning*

The workman of ancient Egypt knew the symbols of his trade. They helped him fashion stone and metal, wood and cloth, into the goods and structures which best served his era. . . . The needs of our modern industrial civilization are different. Visitors to Sun Ship's mighty shops see in the making the intricate steel fabric of petroleum refineries and chemical plants . . . massive bubble towers, pressure vessels, condensers, cracking cases, and a vast array of special

machinery and equipment for many industries.

But even a visitor from the days of Egypt's Pharaohs would recognize two familiar facts—that strange modern "hieroglyphics" guide precise assembly of today's steel behemoths . . . and that Sun Ship workers are masters in their knowledge of the symbols and crafts of their trades. . . . The many modern industries served by Sun know these facts, too.

Illustration at top, reproduced from "The History of All Nations," shows ancient Egyptian shipbuilding as depicted on the tomb of Ti, at Sakkara. In contrast is the 55' regenerator being built by Sun.



Sun

SHIPBUILDING & DRY DOCK COMPANY

(SINCE 1916)

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Chemicals you live by

Can't give you anything but..

Our face is a little red over the tight chlorine supply. During the past five years, especially, DIAMOND has made important additions to its chlorine production capacity. Now we find that despite these expanded facilities we can't meet the demand. Even some of our oldest customers are not getting all they want. And as the mobilization program grows, the situation may get progressively worse.

In the meantime, we CAN continue to offer you the very best in technical help . . . free. Our CHLORINE HANDBOOK is a guide to the proper storage and handling of chlorine. It has been distributed all over the world. If you would like a free copy to help you in your job, write to DIAMOND ALKALI.

We make absolutely no pretense of knowing how much chlorine you should use, or how you should use it. We do claim to know a great deal about shipping, handling and storing chlorine, safely. Our technical advisers are safety experts. They will inspect your chlorine procedure and contribute their highly specialized knowledge to your operations.

During this period of peak demand we promise to do our level best to help you meet your problems. We hope you'll bear with us.



DIAMOND CHEMICALS FOR WATER TREATMENT

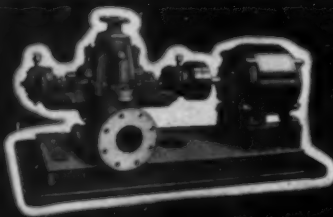
DIAMOND ALKALI COMPANY . . . CLEVELAND 14, OHIO

DIAMOND



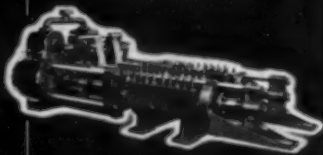
CHEMICALS

Warren-Quimby
Gear-in head Screw Pump



Warren Condensate Pump

Warren Horizontal Duplex
Hydraulic Pump



WARREN PUMPS

Maintain efficiency • Operate at low cost • Are long-lived



Warren Type "L" Single-Stage
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CENTRIFUGAL

Single and Multi-stage
Pressure range: Up to 1200 P. S. I.
Capacities: Up to 50,000 G. P. M.
Types: Horizontal and Vertical
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Horizontal and Vertical Single Piston
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Gear-in-head and External Gear and Bearing
Capacities: Up to 3000 G. P. M.
Pressures: Up to 300 P. S. I. on low viscosity
liquids; practically unlimited on
high viscosity liquids
Horizontal or Vertical Mounting

WARREN-QUIMBY ROTARY PUMPS

Gear-in-head and External Gear and Bearing
Capacities: Up to 1000 G. P. M.
Pressures: Up to 250 P. S. I.
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Send your pumping problem to us; Warren Engineers will recommend the right pump for the job.

P-28



Warren-Quimby External Gear
and Bearing Rotex Pump



Warren Type DBL, Single-Stage
Double Suction, Centrifugal Pump



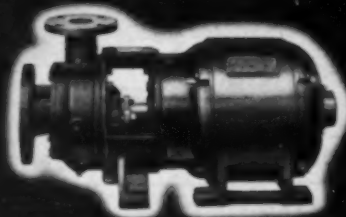
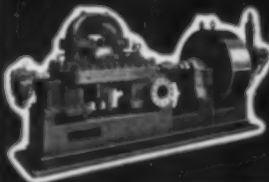
Warren Two-Stage Volute
Centrifugal Pump



WARREN STEAM PUMP COMPANY, INC.

WARREN, MASSACHUSETTS

Warren 4- and 6-Stage
Centrifugal Pumps



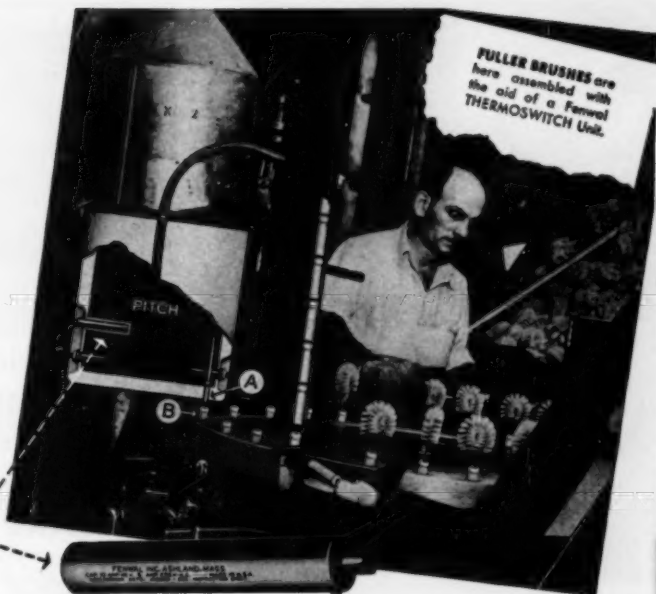
Warren "Compacunit"—4 Types—42 Sizes

Warren Horizontal "Realwear"
Duplex Piston Pump



Multi-Purpose Thermostat solves problem in Fuller Brush assembly— prevents damage to machinery, motor

INVERSE CARTRIDGE THERMOSWITCH UNIT #17001 which closes on temperature rise is inserted in well inside of pitch tank and connected in series to starting switch and magnetic contactors. Machinery operates only when pitch has reached the preset temperature that assures fluidity. It then moves through automatically operated spout (a) into hollow brush handle (b).



When vegetable brushes are assembled at the Fuller Brush plant, a pitch-like sealing compound is poured into the hollow handle of the brush. The brush is then inserted in the handle and completed brush moved on to packing room.

Trouble-point in this procedure was the sealing compound. If it were not heated to a fluid state before machinery was started, automatic spout was broken and motor burned out.

A low-cost Fenwal THERMOSWITCH Unit averted this stoppage by continually, accurately controlling the operation of the motor. Electric motor cannot now start until the compound has reached the desired temperature. Thus damage to machinery as well as motor is prevented.

Easy-to-install, easy-to-maintain Fenwal THERMOSWITCH thermostats solve all types of control problems in industry. Their activating control element is the single-metal shell that expands or contracts *instantaneously* with tempera-

ture changes, making or breaking the totally enclosed electrical contacts. It is this unique principle that enables THERMOSWITCH Units to effectively control *many* variables where heat is a factor.

Mail the coupon today and find out how Fenwal THERMOSWITCH Controls can help you in your own processing.



THERMOSWITCH®

The Precision, Multi-Purpose, Thermostat Control
SENSITIVE...but only to heat



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Get this bulletin . . . see what Fenwal THERMOSWITCH Units can do for you. Just fill in coupon and mail . . . no obligation.

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TEMPERATURE CONTROL ENGINEERS

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City.....Zone.....State.....

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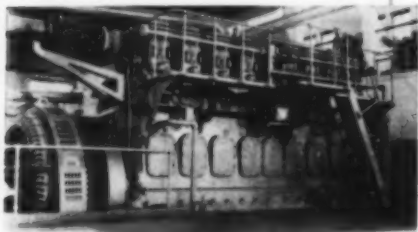
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| <input type="checkbox"/> Heating | <input type="checkbox"/> Timing (thermal) | <input type="checkbox"/> Pressure Control (by controlling vapor temperature) |
| <input type="checkbox"/> Cooling | <input type="checkbox"/> Humidity Control or Detection | |
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OTHER (Please fill in your special requirements)

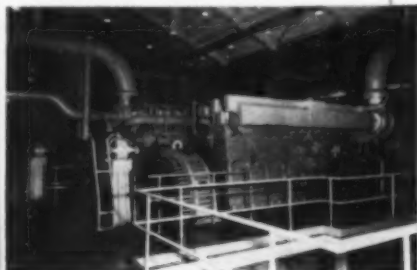
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Four 330 hp, 400 rpm, Cooper-Bessemer compressors, equipped with Ross lube oil coolers, in a Louisiana refinery compressor station.



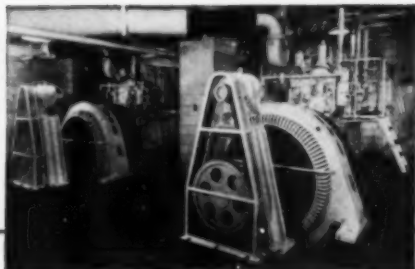
950 hp, 300 rpm, Cooper-Bessemer gas engine, equipped with Ross lube oil cooler, direct-driving generator in a Texas municipal power plant.



1650 hp, 327 rpm, Cooper-Bessemer gas-diesel turboflow engine, equipped with Ross lube oil and jacket water coolers, in an Arizona municipal power plant. Larger Cooper-Bessemer engine in background, also Ross equipped.



Compressor building of a New Mexico natural gas company, housing five, 1100 hp, 300 rpm, Cooper-Bessemer turboflow gas engine compressors, each equipped with Ross lube oil coolers.



Two 485 hp, 400 rpm, Cooper-Bessemer gas-diesel engines, equipped with Ross lube oil coolers, direct-driving generators in a Texas gas company plant.

Peak efficiency, long life and low maintenance of Cooper-Bessemer engines

demand exchangers of same qualities

Rugged, work-wise Cooper-Bessemer engines and compressors are widely known for their peak efficiency, long life and low maintenance. And, Cooper-Bessemer is able to successfully maintain such a reputation *only* by demanding of its components the same rigid standards for engineering and manufacture that it insists upon in its own plant.

The consistent use of Ross lube oil and jacket water coolers is an example of this. Cooper-Bessemer, like other famous makers of Diesels and gas engines, has long relied upon Ross Exchangers to carry the burden of temperature protection . . . a responsibility carried out with eminent success.

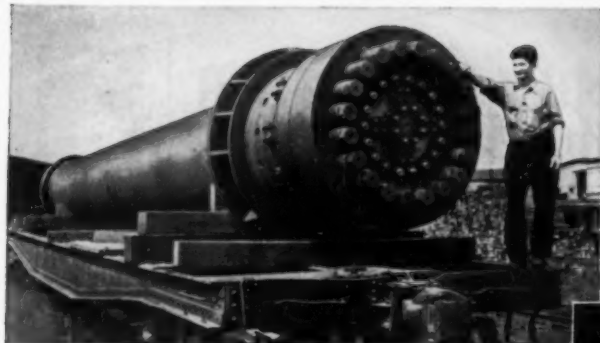
For engines of *any* rating, Ross fully standardized exchangers have unsurpassed advantages. Literature is available with full details. Write.

ROSS HEATER & MFG. CO., INC., Division of American Radiator & Standard Sanitary Corp., 1411 West Avenue, Buffalo 13, N. Y. In Canada, Horton Steel Works, Limited, Fort Erie, Ont.



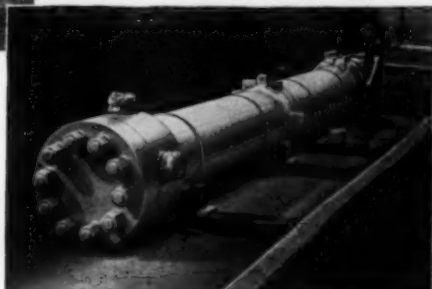
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One of several MULTI-LAYER Converters designed for 5000 psi working pressure, with corrosion-resistant type 405 alloy inner shell. Wall thickness 8 1/4 inches, weight 182,000 lb. This type of construction is ideal for high pressure synthesis of coal and shale.

MULTI-LAYER Heat Exchanger designed for 5100 psi working pressure. Wall thickness 4 1/4 inches, weight 45,800 pounds.



A.O. Smith MULTI-LAYER Heat Exchangers & Pressure Vessels

The practical, economical solution to your high pressure process and storage requirements

MULTI-LAYER vessels are built-up from concentric layers of relatively thin steel plate, progressively wrapped, tightened and welded around an inner, pressure-tight cylinder.

Greater range of process possibilities for the planning and design engineer are provided in this unique, patented construction.



Walls can be made stronger merely by increasing strength of steel wrapping plates or by adding more layers.

For corrosive service, only the inner cylinder need be fabricated of alloy or non-ferrous materials.

No size or weight limitations as MULTI-LAYER vessels or heat exchangers can be made in any diameter for which satisfactory end closures are available.

The full calculated strength of the steel is more fully utilized in MULTI-LAYER vessels. Wrapping tension and weld shrinkage develop compression in the inner layers.

This results in more equalized loading of all portions of the vessel wall under working pressure.



Safety is greatly improved by MULTI-LAYER construction. Only the inner cylinder need be pressure tight! Outer layers are provided with vent holes which protect the vessel against damage from over-pressure. In the remote event of run-away overload sufficient to cause failure, there is little danger of fragmentation of the vessel wall, due to the nature of MULTI-LAYER construction.



Consult A. O. Smith for assistance on your heat-exchanger or pressure-vessel problems. In any event, write for Bulletins V-52 and V-53 for more complete information on MULTI-LAYER Pressure Vessels and their construction... or use handy coupon.



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Without obligation, send me Bulletins V-52 and V-53 on your MULTI-LAYER Pressure Vessels and their construction.

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Hard to freeze— Wyandotte Glycol

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DICHLORIDE • AROMATIC SULFONIC ACID DERIVATIVES
OTHER ORGANIC AND INORGANIC CHEMICALS

A leading producer of glycols, Wyandotte makes Monocol®, a mixture of ethylene and propylene glycol, and Dicol®, a mixture of the corresponding diglycols.

Monocol is an antifreeze. It's used mostly in automobiles, in refrigeration and air conditioning systems. And it's a lubricant in frigid zones.

Monocol and Dicol are solvents. They dissolve dyes and resins for the textile and synthetic resin industries. Either serves as a coupling agent for soluble oils in perfumes, a plasticizer and a humectant.

Our glycols are currently in short supply. But we'd be glad to discuss possible applications to your problem.

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HELPS BAYER CURE A BLENDING "HEADACHE"



Two stainless steel, 10-cubic foot blenders installed by Bayer Aspirin Co.



Large access openings make loading a simple operation.



Smooth interior permits thorough cleaning in a matter of minutes.

Bayer Aspirin Company, determined to maintain the world-famous Bayer standard of quality on an improved, though hard-to-blend aspirin compound, selected two **p-k** Twin Shell Blenders* for this extremely important operation. These Blenders completely eliminated tableting and separation problems which occurred with overblending in other blenders.

A **p-k** Twin Shell Blender mixes dry materials faster and more thoroughly than any other blender on the market. Blender capacities range from 1 to 300 cubic feet; speeds, from 6 to 29 rpm. Mixing time varies with different products, of course, but is consistently shorter than any other blender.

p-k will run experimental mixes of your material without cost or obligation. It will introduce you to a new and accepted theory of dry blending.

*Patented

Send for Catalog No. 401.



p-k

70 years of heat transfer experience assures you of superior design and construction

p-k Mixers
p-k Coolers
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p-k Twin Shell Blenders*
* Patented



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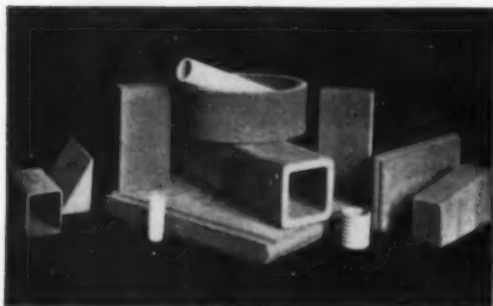
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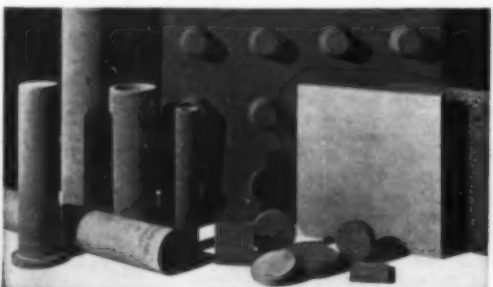
Chemical Stability Contributes to Wider Usage of Fused Alumina



REFRACTORY SHAPES, made of Norton Alundum* mixtures containing 86% to 99.3% fused alumina, resist oxidation in reducing atmospheres at temperatures up to 3450° F. Also highly resistant to chemical attack and mechanical erosion. Write for Bulletin 803.



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Investigate! Maybe Norton Alundum shapes can improve your commercial or laboratory processes. The experience of Norton, pioneers in controlling the chemical and physical variables of fused alumina, is at your disposal. Contact your nearby Norton representative or write direct.

NORTON COMPANY, 502 NEW BOND ST., WORCESTER 6, MASS.

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Special REFRACTORIES

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A. P. GREEN FIRE BRICK CO., LTD. TORONTO, ONTARIO

PEERLESS INDUSTRIAL PUMPS

CUSTOMER: AMERICAN CYANAMID COMPANY

LOCATION: LINDEN, NEW JERSEY (Warners Plant)

TYPE OF PUMP: Peerless Type A, Double Suction,
Split Case, Single Stage

SERVICE: 500 gpm. @ 100#, Alkaline Fluid

REMARKS: Other pumps installed for above customer:

Turbine Vane Type Pumps handling ammonia;











Underwriters' approved Fire Pumps for plant

fire protection. -Locations: Stamford, Conn.;

Piney River, Va.; Jacksonville, Fla.;

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PEERLESS PUMPS FOR INDUSTRIAL SERVICES INCLUDE: General Purpose Horizontal Pumps ; Chemical Pumps ; Acids and Caustics Pumps ; Turbine (Vane type) Pumps ; Deep Well and Close-Coupled Turbine Pumps ; Industrial Wastes Pumps ; Boiler Feed Pumps ; Underwriters' Approved Fire Pumps ; Vertical Centrifugal Process Pumps . Also available for application to the above: Peerless Mechanical Shaft Seals . Write today for descriptive Bulletins on products of interest to you.



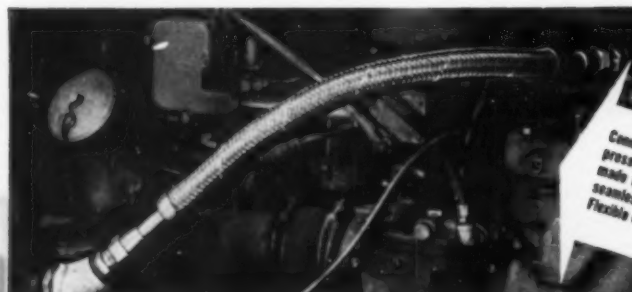
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wherever connectors must move



Connection between air compressor and ping chamber is made through this 3/4" I. D. seamless bronze American Flexible Connector.



This 3/4" I. D. seamless bronze American Flexible Connector on a C. R. & L. Motorbus carries air from compressor to reservoir.

Photos courtesy Connecticut Railway & Lighting Lines.

Air-line piping for motorbus brakes and doors takes constant punishment from movement and vibration. In the piping illustrated here, American Seamless Flexible Metal Tubing provides safe, flexible connectors that can bend freely as the piping moves and vibrates.

There is a type and size for carrying fluids, steam, semi-solids, or gases. If yours is a special problem, American engineers offer you their long years of varied experience in connector applications.

For complete information on American Flexible Metal Hose and Tubing, write for literature. Address your inquiry to The American Brass Company, American Metal Hose Branch, Waterbury 88, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd.

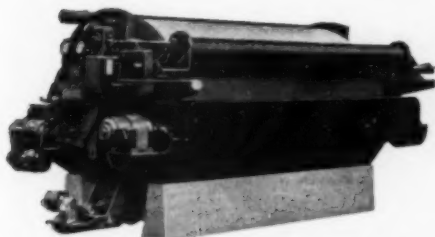


American

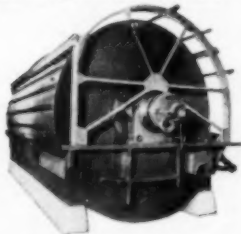
flexible metal hose and tubing

OLIVER

**Each the Nemesis of Pulps Forming
Thin, Sticky, Flow-Retarding Cakes**



• The Oliver Preccoat Filter operates in continuous cycles with a pre-formed 'precoat' of suitable porous material such as diatomaceous earth. Solids form a thin film on the surface of this precoat which is shaved off by a traveling knife edge as the drum rotates, leaving continually a fresh surface of precoat for cake deposition. Actual filtration continuous for periods ranging from 8 hours to several weeks before the precoat is used up and a new one has to be formed. Precoating takes an hour or two.



• The Oliver Panel Filter in contrast to the Preccoat Filter doesn't use a precoat. Nor is there any wire winding to hold the cloth on the drum. An ingenious discharge mechanism picks the thin cake off the cloth leaving it clean and ready for further cake deposition. The cloth is in a relatively small piece and is held in place by caulking into recesses between sections.

**Precoat
FILTER**
**Panel
FILTER**

WHY two distinctly different filters for handling pulp forming one class of filter cake? Another question answers that one: "What do you want to do with the cake? Keep it or throw it away?"

The Preccoat Filter makes use of a pre-formed layer or 'precoat' of filter aid which, as it is removed with the cake, mixes with it. Usually such cakes are discarded, although it is often possible to separate the solids from the precoat by a suitable solvent.

The Panel Filter does not use a precoat or pre-formed layer of filter aids. Thus it discharges the solids uncontaminated in any way. It, too, handles easily those thin, sticky, flow-retarding cakes. It is usually recommended when the cake is valuable or is to be processed further. We call these two filters to your attention in case you wish to obtain the advantages of continuous and automatic filtration of a pulp that for one reason or another produces an extremely thin cake.

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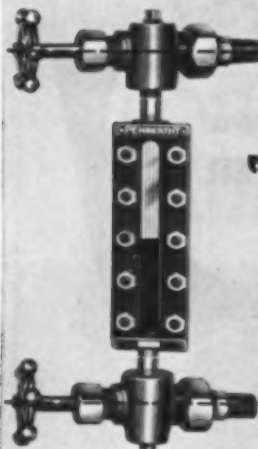
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Penberthy Transparent Gage



PENBERTHY "FLOATING SHANK" Permits $\frac{3}{8}$ " Variation in Center-to-Center of Vessel Tapping

Patent Applied for

**COMPENSATES FOR VESSEL
TAPPING INACCURACIES
•
SAVES INSTALLATION TIME
•
REDUCES GAGE STRESSES**

*Another
PENBERTHY
First*

An important new feature now available on all Penberthy drop forged steel gage valves is the "floating shank" . . . an improvement that has money-saving advantages to many users of liquid level and water gages.

The "floating shank" compensates for inaccuracies in the center-to-center distance of the tapped holes in the vessel on which the gage is mounted. The variation can be as much as $\frac{3}{8}$ ". It provides a mounting flexibility not elsewhere obtainable . . . it saves time during installation of the gage . . . it eliminates stresses that are often induced during mounting.

The Penberthy "Floating Shank" can be had at slight additional cost . . . specify it on your next order for Penberthy drop forged steel (or alloy) gage valves.

OTHER PENBERTHY PRODUCTS

PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



PENBERTHY EXPLOSION-PROOF SUMP PUMPS

Motor and switch totally enclosed. Underwriter approved for Class I, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.



PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Ask for Bulletin 5080.

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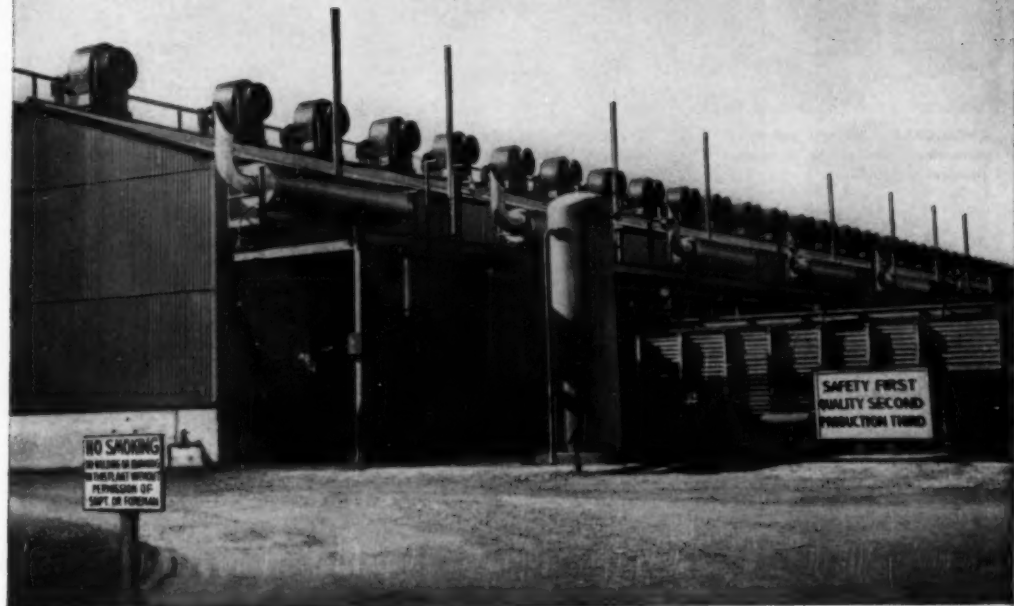
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PUTTING *Air* TO WORK



28 LUNGS THAT EXHALE AN EXPLOSIVE HAZARD

Every 60 seconds there must be a complete change of air in this building. Reason: to prevent the accumulation of explosive hydrogen, used in manufacturing ammonia. But what could be a dangerous process is made safe in one of the newest synthetic ammonia plants recently built in the Southwest by exhausting air through Sturtevant Elbow Axial Flow fans . . . 28 strong, right down the rooftop.

Strong north winds can't "back pedal" those fans . . . and rain is completely shut out. Motors, bearings and

belts are located outside the air stream, an industry-proven advantage in exhausting corrosive fumes.

To meet the need for efficient fume or vapor removal in your plant—as well as air conditioning, air handling or air cleaning—there is Sturtevant equipment specifically designed to help you put air to work. Contact your local Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S

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PUTTING *Air* TO WORK

J-80209



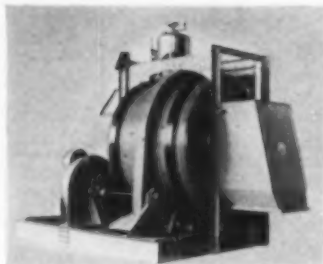
INDUSTRIAL FANS

AIR CONDITIONING

ELECTRONIC AIR CLEANERS

AIR HANDLING APPARATUS

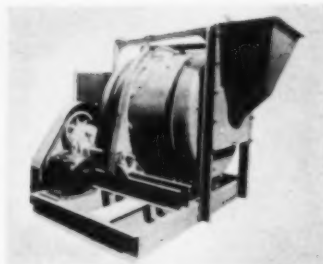
HEATING AND VENTILATING



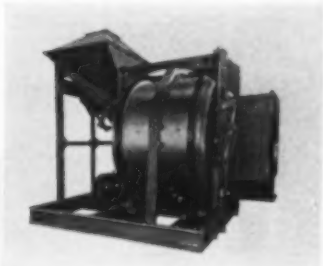
CHEMICALS—Equipped with liquid measuring tank for use in various chemical applications.



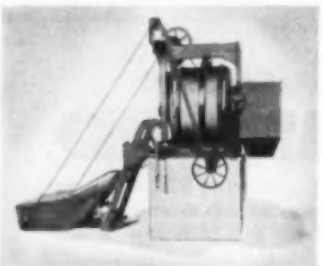
CHEMICALS • DRUGS • PLASTICS METALS • FOOD • CANDY—Pan is tilted and rotated by motors. Capacities up to 3090 lb.



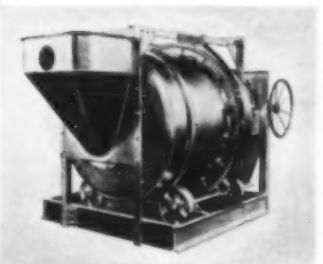
COMPOSITION MATERIALS • INSULATING AND REFRACTORY CHEMICALS • CLAY • GLASS BATCHES • FOUNDRY CORE SAND—13 cu ft dry mixer on skids.



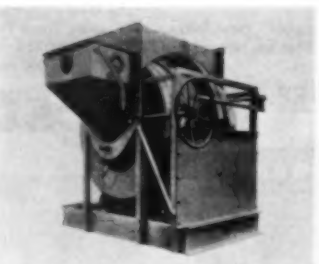
ENAMEL FRITS • GLASS—50 cu ft dustproof mixer. Fully-automatic, electrically controlled charging and discharging.



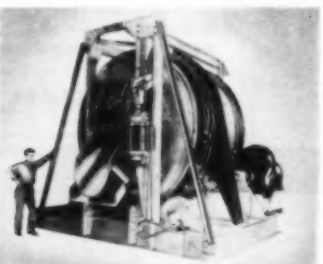
FURNACE CHARGES • GLASS BATCHES—28 cu ft mixer with elevating power loader.



SOAP POWDER • PIPE TOBACCO • SNUFF—Dustproof mixer for blending and mixing.



FERTILIZER—Standard sizes, 1/2, 1, 2-ton capacity. Also used for asbestos products, etc.



FURNACE CHARGES—One of the largest industrial mixers—batch capacity of 260 cu ft.

How To Straighten Out Your Mixer Problems

What do you mix? Here's a partial line-up of industrial mixers bearing the famous Worthington-Ransome trademark—which means the right design for every type of mix.

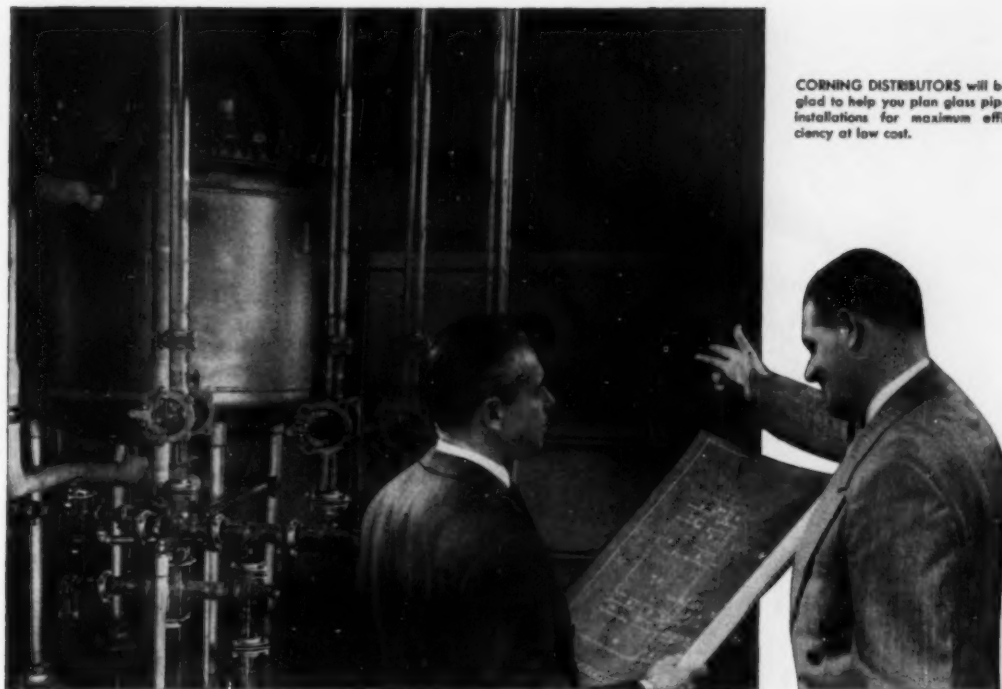
And you'll find in every mixer the following Worthington-Ransome features: *thorough mixing* (or blending) of even the finest dry materials or colors in any proportion . . . *clean discharge* . . . *dustproof design* (where required) . . . *heavy-duty construction*.

For solution of your particular mixing problem or for free bulletins, write: Worthington Pump and Machinery Corporation, Ransome Industrial Mixer Division, Dunellen, New Jersey.

WORTHINGTON



YR.1



CORNING DISTRIBUTORS will be glad to help you plan glass pipe installations for maximum efficiency at low cost.

Let Corning distributors help solve your piping problem with Pyrex brand "Double-Tough" glass pipe!

Whenever you have a pipeline transfer problem involving corrosive liquids, gases, and fluids sensitive to contamination, PYREX brand "Double-Tough" glass pipe will provide an economical, practical solution. *It is available now through strategically-located distributors.* They are prepared to help you layout, and install PYREX pipe. They are ready to fill your order promptly from full stocks of all popular sizes.

PYREX BRAND "DOUBLE-TOUGH" GLASS PIPE costs less than any other corrosion-resistant piping material—based on initial cost, installation cost and over-all service life. It is not only highly resistant to corrosion, but also provides visual check of flow—trouble can't hide behind glass.

EXTRA STRENGTH is built into PYREX pipe with a new heat treating process that doubles the strength of ends of straight lengths and all standard fittings (except U-bends). It is made from machine drawn heavy wall tubing that withstands elevated temperatures. Call in your nearest Corning Distributor, or use the coupon below for complete information.

Authorized Distributors of PYREX Brand "DOUBLE-TOUGH" PIPE

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Technical Products Division: Laboratory Glassware, Signalware, Glass Pipe, Gouge Glasses, Lightingware, Optical Glass, Glass Components

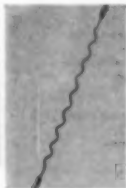
CORNING GLASS WORKS, Dept. CE-4, Corning, N. Y.
Please send me your new Pyrex Brand "DOUBLE-TOUGH" Glass Pipe Catalog.

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____



How much Valuable Dust can you Economically Recover?

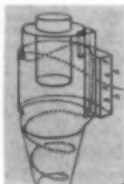
Only Buell Incorporates these Efficiency Building Advantages



Buell 'SF' Electric Precipitator:
StediFLOW Dust Fall assured through carefully timed, continuous-cycle rapping of plates in line.

Exclusive self-tensioned Spiral electrodes for greater corona emission without danger of flash-over.

Buell van Tongeren Cyclone:
Exclusive van Tongeren "shave-off" principle of Buell Cyclones permits sustained efficiencies, substantially higher than those of any other kind of mechanical collection.



Unique advantages of Buell Equipment couples Peak Efficiency with Peak Economy in Valuable Dust Recovery!

In the recovery of valuable dust, a line must be drawn between the limits of peak efficiency and practical economy.

For, as you know, there is a degree of efficiency, beyond which, recovery becomes economically unsound.

Buell dust collection equipment was designed with this premise in mind. Its specific operating advantages permit dust recovery efficiencies beyond those of ordinary collection devices.

Experienced Buell engineers are qualified to show you how to economically increase your valuable dust collection efficiency with either a Buell 'SF' Electric Precipitator, a Buell mechanical collector, or a combination system utilizing both. They will be glad to discuss your problem with you. Write for an appointment today, or ask for the Buell catalog. Buell Engineering Company, 70 Pine St., Suite 5040, New York 5, N. Y.



buell

Engineered Efficiency in Dust Recovery

*Dependable
Records with*

HAGAN

RING BALANCE METERS

In every flow distribution system, it is important that the record of total flow balance with the sum of individual flows, so that costs can be allocated properly.

With Hagan Ring Balance Meters, the records and totalized flows are accurate over the full meter range, and distribution costs can be made on the correct basis.

Hagan Ring Balance Meters are available in single or dual models, with or without automatic pressure and temperature compensation, and for full scale differentials up to 420" of water.

For more information about Hagan Ring Balance Meters, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.

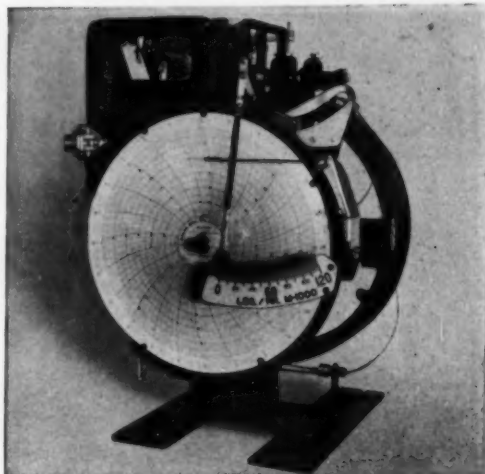
HAGAN CORPORATION

RING BALANCE FLOW AND PRESSURE INSTRUMENTS

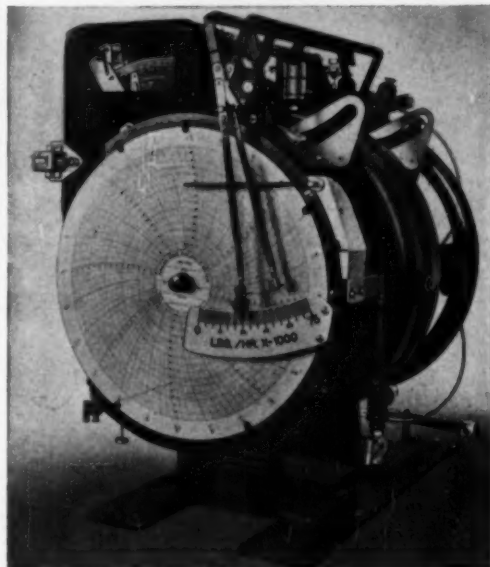
THRUSTOR FORCE MEASURING DEVICES

BOILER COMBUSTION CONTROL SYSTEMS

METALLURGICAL FURNACE CONTROL SYSTEMS



Hagan Ring Balance Meter for maximum differential of 420" water column.



Hagan Ring Balance Dual Meter with one high pressure ring and one low pressure ring; integrator; and strip type indicating arc.

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Hagan Building
Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ring Balance Meters. I am particularly interested in _____

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POSITION _____

COMPANY _____

STREET AND NUMBER _____

CITY _____ ZONE _____ STATE _____

CE-4

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NO more exacting tests could be applied to any product than those to which our platinum laboratory ware is subjected. The tests are continuous, because we maintain and operate large scientific laboratories and naturally employ our own laboratory ware in them.

The consequence is that any divergence from our high standards, any defect in manufacture, would show up inevitably.

All this makes it doubly safe for you to adopt Baker Laboratory Ware as standard equipment. You can't possibly go wrong in choosing it.


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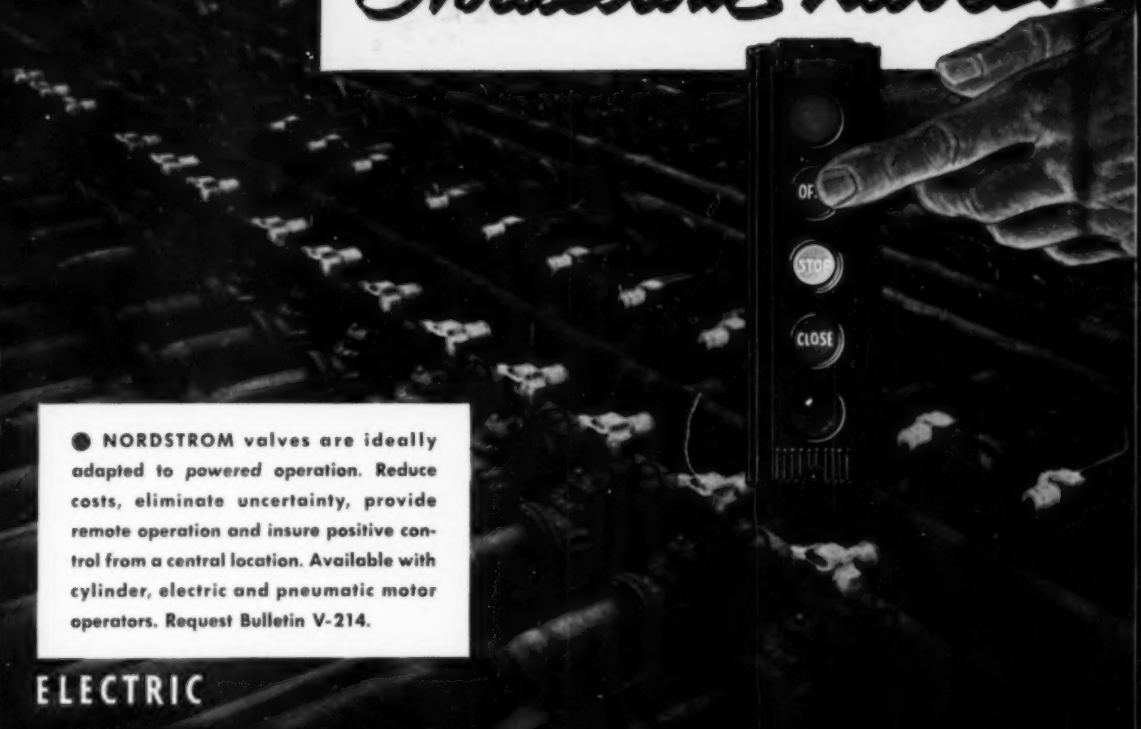
CHICAGO 2



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POWER OPERATED

Nordstrom Valves



● NORDSTROM valves are ideally adapted to powered operation. Reduce costs, eliminate uncertainty, provide remote operation and insure positive control from a central location. Available with cylinder, electric and pneumatic motor operators. Request Bulletin V-214.

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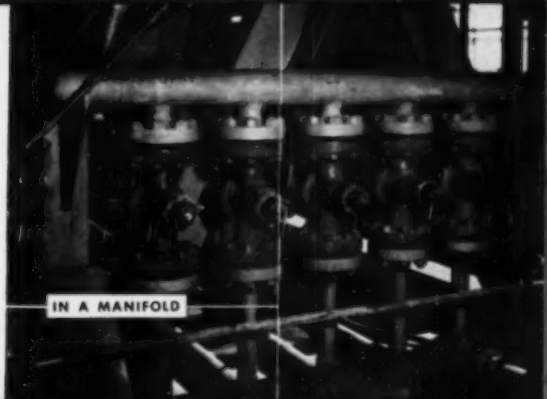


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You'll find NORDSTROMS everywhere



MOTOR OPERATED



IN A MANIFOLD

Replace ineffective valves with NORDSTROMS



ON HEAT EXCHANGERS



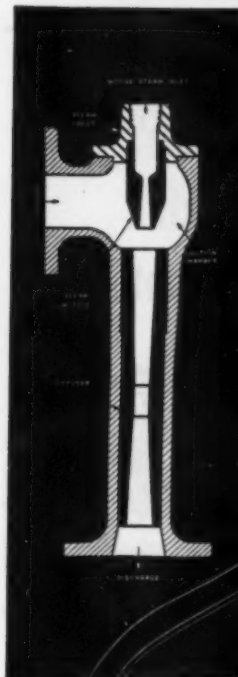
IN PROCESSING PLANT

KEEP UPKEEP DOWN



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Atlanta, Boston, Chicago, Columbus, Houston, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco, Seattle, Tulsa...
and leading Supply Houses. Export: International Division, Rockwell Manufacturing Company, 7701 Empire State Building,
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C.H. Wheeler **ENGINEERS** help you reduce refrigeration costs

5 to 20%
in chemical processing



Steam Jet Vacuum Refrigeration
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They can help you save 5 to 20% over the cost of mechanical refrigeration, if you have live or exhaust steam available, and require moderate chilled water temperatures from 35° to 65°F. Purchase price is lower, because units are standardized in a wide range of sizes. Installation costs less. And — most important of all — long range maintenance cost is lower. There are no moving parts in the system except the chilled water pump.

Employing only water, cooled by flash evaporation, you eliminate hazards of noxious and poisonous refrigerants.

Most C. H. Wheeler installations are of a confidential nature. Our engineers will be glad to work with you in applying the correct vacuum equipment for your process.

Catalog 1462, yours for the asking, has many suggestions and charts of value to you who have a vacuum or refrigeration problem.

C.H. Wheeler
OF PHILADELPHIA

VACUUM REFRIGERATION—COOLING TOWERS—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE
REDUCTION MILLS—STEAM CONDENSERS—STEAM JET EJECTORS—MARINE CONDENSERS & EJECTORS—DECK MACHINERY

C. H. WHEELER MANUFACTURING CO., 1808 SEDGLEY AVE., PHILADELPHIA 22, PA.

REPRESENTATIVES IN MOST PRINCIPAL CITIES

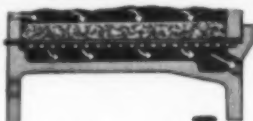
HIGH FLOW RATES

WITH SPARKLER FILTERS

... frequently two to five times as high as the flow through filter septa lying in a different plane.

In Sparkler filters, friction encountered in high flow and high viscosity operations is reduced to a negligible factor by the free drainage and uniformity of cake provided by Sparkler's horizontal plate construction. Less operating pressure is needed, with the result that the cake is less dense and thus offers less resistance to flow.

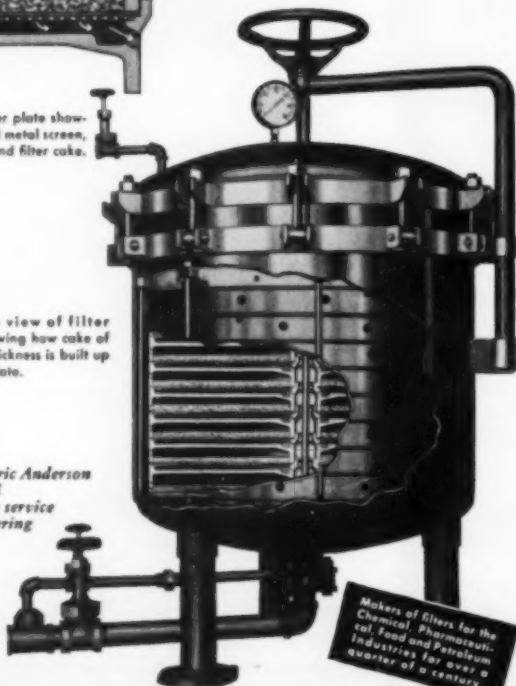
Sparkler horizontal plates permit filter media to be floated into position forming a cake of uniform thickness. Only a thin pre-coat cake is necessary to assure brilliant clarity of the filtrate right from the start. This means maximum economy of pre-coat material and pre-coating recirculating time.



Section of filter plate showing perforated metal screen, filter media, and filter cake.

Cutaway view of filter plates showing how cake of uniform thickness is built up on each plate.

Write Mr. Eric Anderson for personal engineering service on your filtering problem.



Makers of filters for the Chemical, Pharmaceutical, Food and Petroleum Industries for over a quarter of a century.

SPARKLER MANUFACTURING COMPANY Mundelein, Ill.

"But
you can't buy
that kind
of a motor..."



9-14A

How many times have you heard somebody that ought to know better say something like that about motors, pumps, compressors or what-have-you? And how many times have you heard somebody else say, "Oh yes you can! I saw just what we need in Blank Company's ad yesterday." Advertising pages in this magazine are packed with news about your business. They contain information about products and services designed to help you do your job quicker, better and cheaper. To be well-informed in your business, your industry . . . about the latest developments and to stay well-informed . . . read all the ads too.

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It's the Nash!

The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

No internal wearing parts.
No valves, pistons, or vanes.
No internal lubrication.
Low maintenance cost.
Saves floor space.
Desired delivery temperature
Automatically maintained.
Slugs of liquid entering pump
will do no harm.
75 pounds in a single stage.

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ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.



**NEW Cyclonic
COMBUSTION**

**LOWER INSTALLATION COSTS
UP TO 50% SAVINGS ON MAINTENANCE
QUICKER HEAT
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LOWER FUEL BILLS**



Factories, Public Buildings, Institutions all over America are finding out what the U. S. Navy discovered during the last war: CYCLOTHERM'S Cyclonic Combustion Steam Generators do a BETTER job, quicker and cheaper.

Proof of this statement and why it is true may be had by writing the Cyclotherm Corporation directly or check your phone book for your local Cyclotherm office.

Boilers designed for oil or gas. From 18 thru 500 h.p., 15 to 200 lbs. operating pressure.

For further information, write Dept. E

CYCLOTHERM CORP., OSWEGO, N. Y.

How your dollars
**STRIKE BACK
AT CANCER**



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RESEARCH
that saves lives

In the past six years, the American Cancer Society has devoted \$16,856,000 to the support of *Research*, chief hope of millions of threatened cancer victims. Science has given us improved techniques in diagnosis and treatment that have saved thousands of lives. Your contribution to the Society also supports *Education* and *Service* to the cancer patient.

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CANCER SOCIETY**



Mail your contribution to
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your local post office



IF IT'S

here...

IT'S news...

IT'S WORTH
STOPPING TO SEE

Maybe Industry doesn't maintain show windows on Fifth Avenue or State Street or Wilshire Boulevard like America's great department stores. But your industry has a mighty effective show window ... and this is it ... this magazine. In these advertising pages alert manufacturers show their wares. Here you will find up-to-the-minute news about products and services designed to help you do your job better, quicker, and cheaper. To be well-informed about the latest developments in your business, your industry ... and to stay well-informed ... read all the ads too.

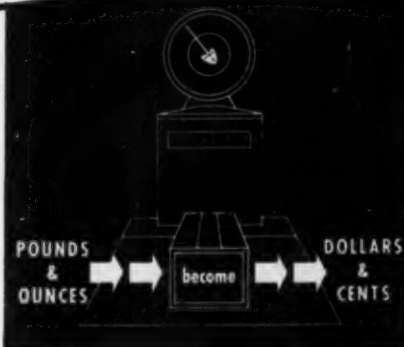
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PUBLICATIONS**



CHEMICAL ENGINEERING—April 1951

MATERIAL becomes Money on your SCALES!

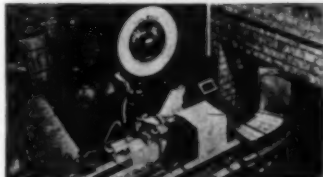
Errors made at the scale stay wrong forever. There is no chance to recheck; either the material has been shipped or, if incoming, has lost its identity in the general stock. You've got to be right—weigh it right—Toledo Printweigh means accurate weights accurately recorded!



STOP HUMAN ERRORS with PRINTWEIGH



Chemical laboratories depend on Printweigh accuracy



Shipments automatically checked and weights printed

PRINTWEIGH SCALES give you accurate printed records of each weighing operation in your chemical plant ... positive assurance that your weight facts are right every time! Prints big, clear figures on tickets or strips. Saves time, stops losses, improves product quality—for weighing, checking, testing, counting, batching, force-measuring. Send for bulletin 2021 on modern weight control.



TOLEDO

HEADQUARTERS FOR SCALES

TOLEDO SCALE COMPANY
1209 Telegraph Rd., Toledo 1, Ohio

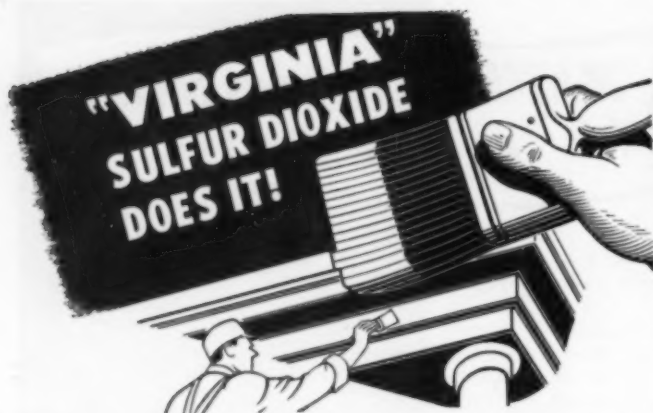
Please send me bulletin 2021 describing Toledo weight control.

NAME _____

COMPANY _____

ADDRESS _____

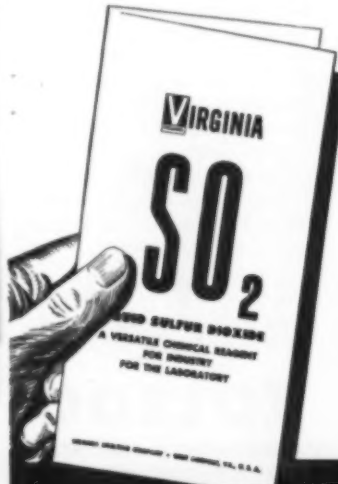
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Drying Oils "Bodied" in Half the Time

Raw oils—linseed, soya and tung, for examples—are unsuitable for use in paints, varnishes and printing inks. They must be "bodied," given added viscosity and quicker drying properties.

"Virginia" engineers have demonstrated that the catalytic action of sulfur dioxide does four important things: (1) speeds up polymerization, (2) cuts heating time in half, (3) blankets oils in process against atmospheric oxidation, (4) produces a lighter colored, more salable end product, all this while nearly doubling the output of existing equipment!



This is typical of the way in which "Virginia" chemicals and technical aids have been giving yeoman service in 40 widely diverse industries over the past 29 years. Low-cost, versatile "Virginia" SO_2 is in special demand as a reducing and bleaching agent, preservative, anti-chlor, neutralizer, and pH control. "Virginia" is the world's largest producer of SO_2 .

Let us explore with you the potentialities of "Virginia" SO_2 for the improvement of your products or processes. Send today for our folder explaining its varied properties and uses. VIRGINIA SMELTING COMPANY, Box 21, West Norfolk, Virginia.

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NIAGARA FILTER

simplifies recrystallization of organic chemical

THIS NIAGARA FILTER quickly separates crystals from the crude "mother liquor", then redissolves the pure crystals. It replaces space-consuming plate and frame presses, and is operated by one man.



New filter pays for itself in one year

A new technique in the recrystallization of organic chemicals has been adopted by a large American organics producer* with the aid of a Niagara Filter, resulting in economies in equipment, materials, time and labor.

One all-stainless-steel Niagara Filter with 512 square feet of filter area replaces more than 900 square feet of plate-and-frame press area. It does a better job, quicker, with one-man operation (instead of four) and eliminates cloth replacement and other maintenance expense. *The reduction in cost pays for the Niagara Filter out of one year's savings.*

The new filter quickly separates crystals from the crude "mother liquor," after which the filter itself is used for recirculation of hot water through the crystalline filter cake until all the pure crystals

* Name on request.

have been redissolved. Thirty cubic feet of these crystals are processed in less than two hours without the need of opening and cleaning the filter, and without the need of a separate dissolving tank. Just another case where a Niagara Filter replaces a messy, laborious filtration job with a simple, clean and economical operation.

Niagara Filters eliminate the need for cloths, provide flow rates 2 to 5 times higher than conventional presses, and reduce manpower and maintenance cost. Compact vertical design saves floor space. Completely enclosed, they prevent product contamination, are ideal for toxic, flammable and explosive materials.

Niagara engineers offer you complete service on chemical filtration problems. Write, describing your needs—or send the coupon for information on Niagara Filters, pilot plant filter rental and other services.



Niagara Filter
CORPORATION

NIAGARA FILTER CORP., 3847 Main St., Buffalo 14, N.Y.

Please send information on Niagara Filters ☐
Pilot filter rental ☐

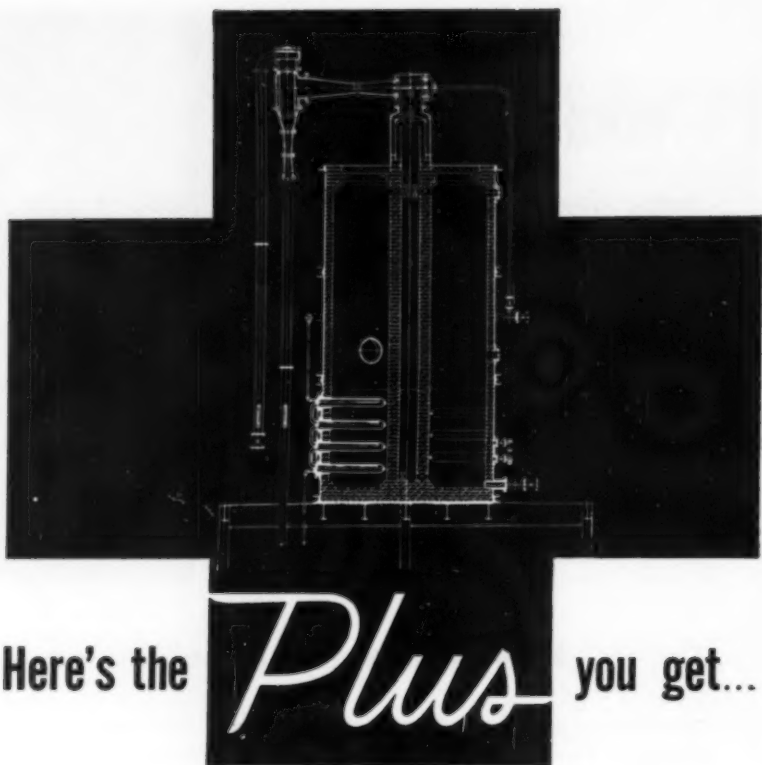
Name

Title

Company

Address

City State



Here's the

Plus

you get...

...when you recover acid
the Simonson-Mantius way

Maybe you're looking into acid recovery as a hedge against rising sulfur prices.

Maybe you're doing it to protect your own and the nation's sulfur supply lines. Or for local reasons.

Whatever your purpose, it will pay you to investigate the Simonson-Mantius Vacuum Process—now in successful use for more than a quarter of a century.

With Simonson-Mantius equipment, you get efficient, economical acid recovery. Acid losses, due to leaks or other factors, are kept to a minimum.

You also get this important S-M plus: fumeless operation. Fumeless because it's effected in closed vessels, under vacuum.

Today, Simonson-Mantius units are efficiently recovering big tonnages of acid in chemical process plants all over the country. And, because of the S-M plus of fumeless operation, these units are also delivering a priceless by-product of goodwill.

Our long and wide experience in solving spent acid problems is yours to draw upon.



NATIONAL LEAD COMPANY
Acid Recovery Department

*Reg. U. S. Pat. Off. 111 Broadway, New York 6, N. Y.

POWELL Corrosion-Resisting VALVES

There are Powell Valves made of the right materials* to meet all requirements of the CHEMICALS AND PROCESS INDUSTRIES

*Powell Valves are available in the greatest variety of Corrosion-Resistant Metals and Alloys ever used in making industrial flow control equipment.



Fig. 2433 S. S.—Large size Stainless Steel flanged end Swing Check Valve for 150-pound W. P. Bolted cap with body-cap bolts and nuts in Stainless Steel. All dimensions conform to latest standards. Available in various other corrosion-resisting metals and alloys. Also made with screwed ends.

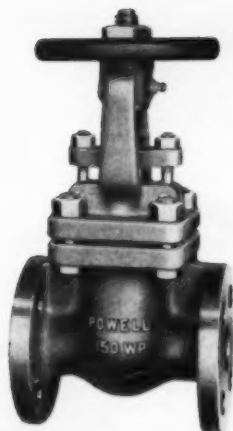


Fig. 2491—Flanged End Stainless Steel O. S. & Y. Gate Valve for 150 pounds W. P. Supplied with precision fitted, quickly interchangeable, solid or split wedges. Stem is threaded and guided through a revolving bushing. Body-bonnet bolts and nuts and packing gland eye-bolts and nuts are Stainless Steel. Compression lubricant fitting in upper yoke. All dimensions conform to latest standards. Available in various other corrosion-resisting metals and alloys. Also made with screwed ends.

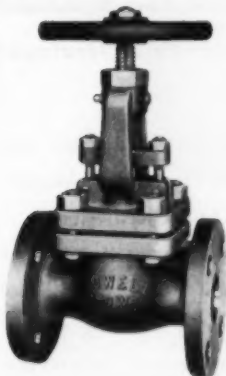


Fig. 2475—Flanged End Stainless Steel O. S. & Y. Globe Valve for 150 pounds W. P. The stem is threaded and guided through a bushing screwed into upper yoke. Plug type disc and seal can be easily re-ground, if necessary. Body-bonnet bolts and nuts are Stainless Steel. Compression lubricant fitting in upper yoke. All dimensions conform to latest standards. Available in various other corrosion-resisting metals and alloys. Also made with screwed ends.

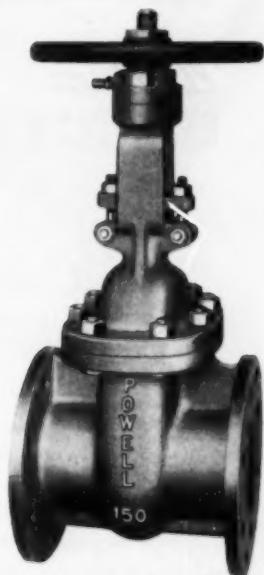


Fig. 2453-G—Flanged End Stainless Steel O. S. & Y. Gate Valve for 150 pounds W. P. Interchangeable solid or split wedges are precision fitted and accurately guided throughout entire travel. Body-bonnet bolts and nuts and packing gland eye-bolts and nuts are Stainless Steel. Compression lubricant fitting in upper yoke for lubricating stem threads and bushings. Sizes 2½" to 4", incl. Sizes 5" to 30", incl. have separable yoke-arms. All dimensions conform to latest standards. Available in various other corrosion-resisting metals and alloys. Also made with screwed ends.

POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

➡ ➡ Pointing the Way... the **NEW WAY** in
**CONTINUOUS
 CHEMICAL FEEDING...**

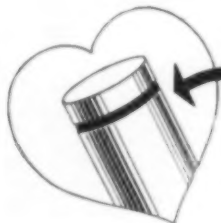


Neptune

CHEMICAL APPORTIONING PUMP

For Boiler Feed-Water Treatment

LEADERS IN INDUSTRY have tested and warmly endorsed this *advanced idea* for the treatment of boiler feed-water. The new Neptune Pump brings *finer controls* . . . an easy-working simplicity that eliminates costly servicing and delays . . . important "reserve" features that assure uninterrupted pump performance.



NEPTUNE "O" RINGS*
 . . . heart o' the pump!

No more leaking packings and scored pistons! The remarkable Neptune "O" Rings assure long and dependable service, new economies in operation and upkeep. An "O" Ring can be changed in 30 seconds . . . saving many hours in pump maintenance.

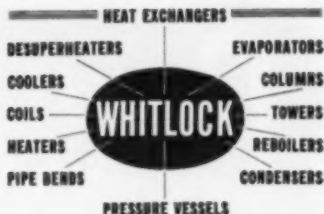
*Patent Pending

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 Vapor in shell — water in tubes.

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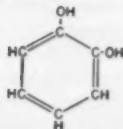
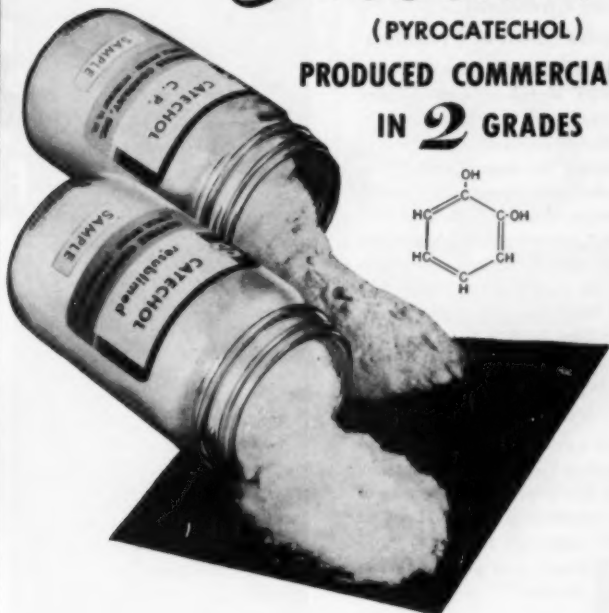
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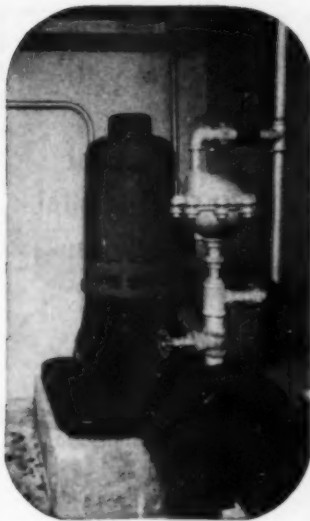
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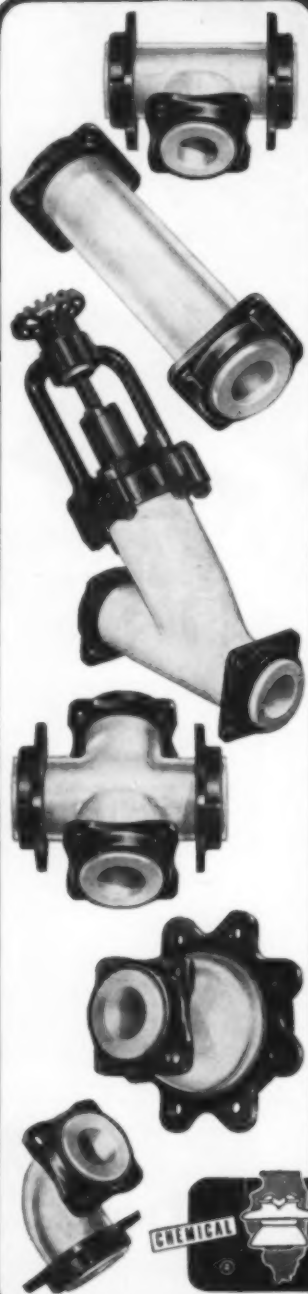
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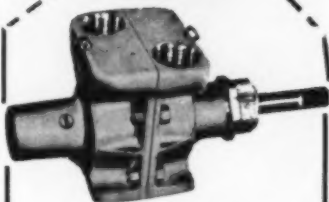
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But America's unmatched productive might is fully capable of building bathtubs and battleships, of providing butter and the bombs requisite to war or to prevention of war; capable, that is, if properly employed—if none of it is wasted.

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THIS means that the manpower and womanpower left to industry after military needs have been satisfied, must be given every cost-cutting tool, every time-, labor- and muscle-saving aid known to man. It means that these tools must be employed intelligently and efficiently.

At the Fourth National Materials Handling Exposition,* to be held in the International Amphitheater in Chicago, April 30—May 4, 1951, the CLARK EQUIPMENT COMPANY'S INDUSTRIAL TRUCK DIVISION, along with several hundred other producers of materials-handling equipment, will show to industry the newest, the most efficient and the most effective tools in the world for making the most of America's productive might. It is a show that no industrial executive can afford to miss—it is the MUST of the Industrial Show year. It is a MUST not only from the point of economy and profits within your own operation—but also from the point of accomplishing the vast production necessary to the new Military Economy without imposing harsh austerity on the Civilian Economy.

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in Confidence and
Without Obligation.*

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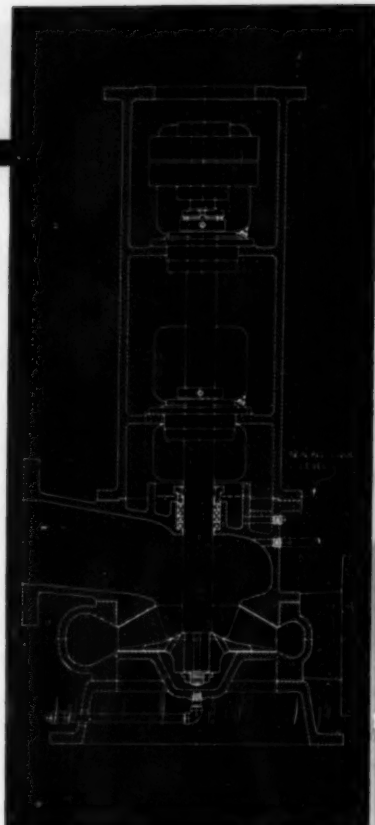
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Right: Cross-section of Lawrence
Vertical Top Suction Pump for
pumping volatile liquids.

Below: Vertical Top Suction Pump.



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- Under a Low Net Positive Suction Head (NSPH)
- Under a High Vacuum
- Without Air or Vapor Binding

When handling volatile liquids under a very low Net Positive Suction Head—from evaporators, for example—a horizontal pump is apt to become vapor-bound. Air or vapor binding is impossible if you install the Lawrence Vertical Top Suction Pump illustrated above. Extremely high vacuums are maintained by filling the space around the packing box with water or some other sealing liquid. The costly delays and shutdowns resulting from vapor binding and loss of vacuum are completely eliminated.

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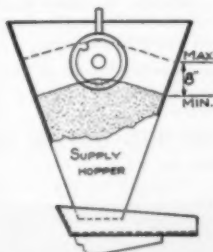
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**SALES
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A black and white cartoon illustration of a man in a bowler hat, a plaid jacket, and a tie. He is holding a cane in his right hand and pointing with his left hand towards the right. He has a wide, happy smile. The background is simple with some curved lines suggesting a path or a wall.

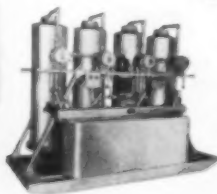


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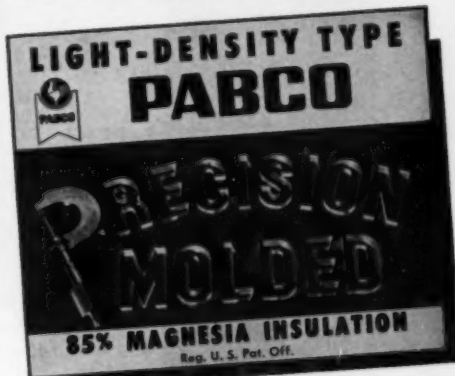
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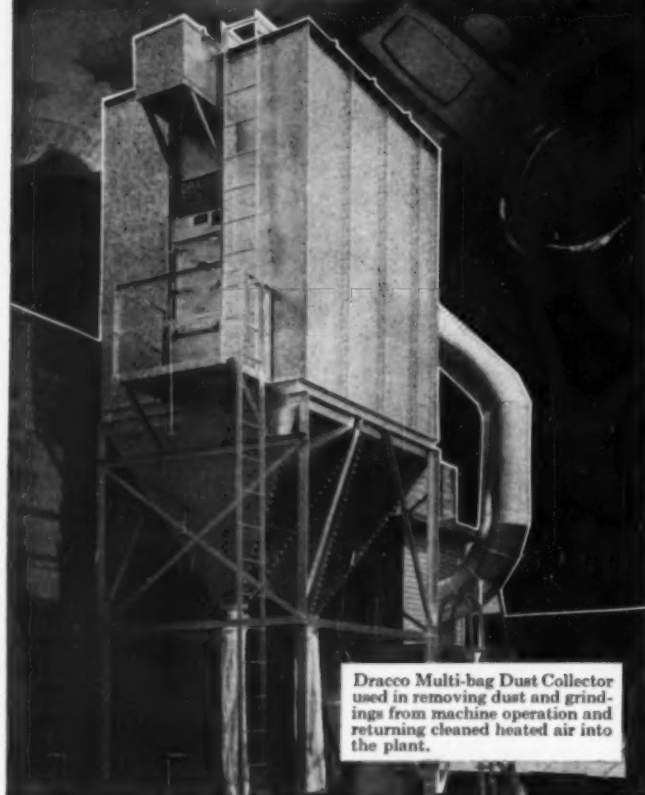
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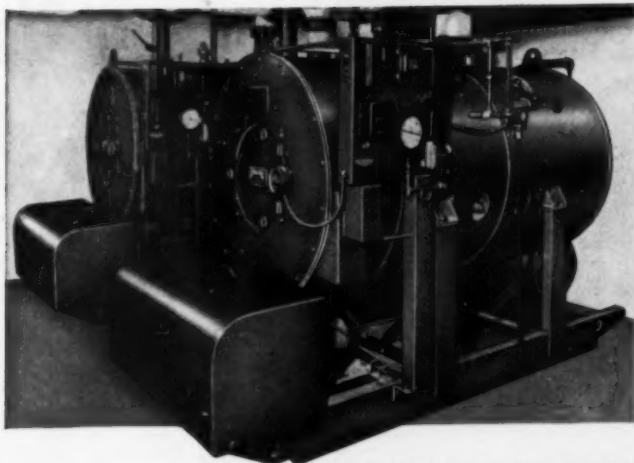
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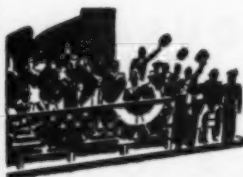
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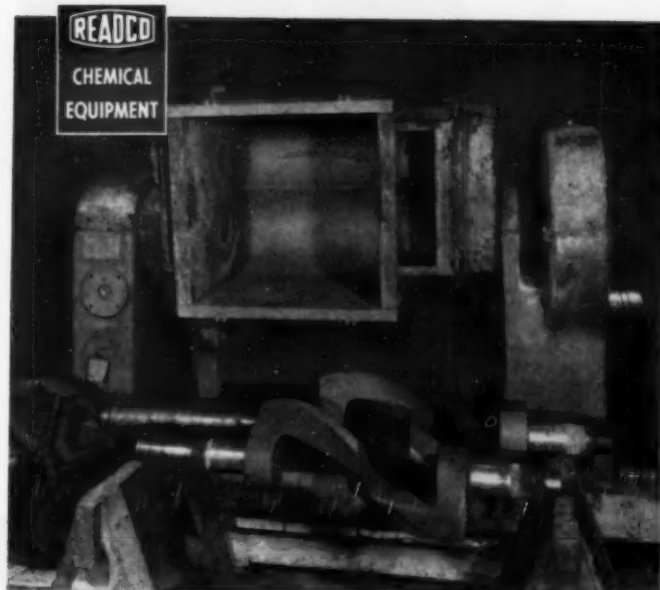
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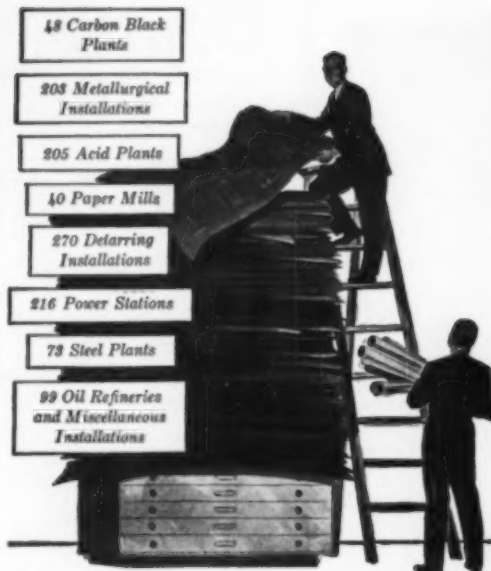
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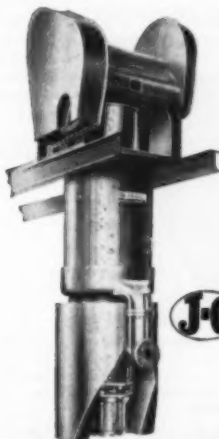
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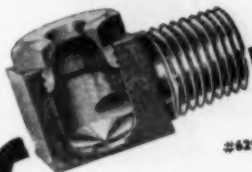
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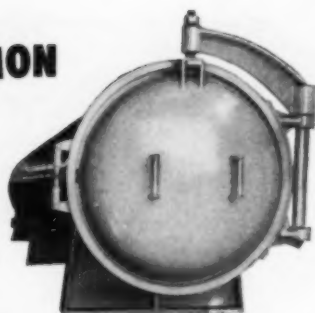
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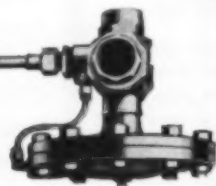
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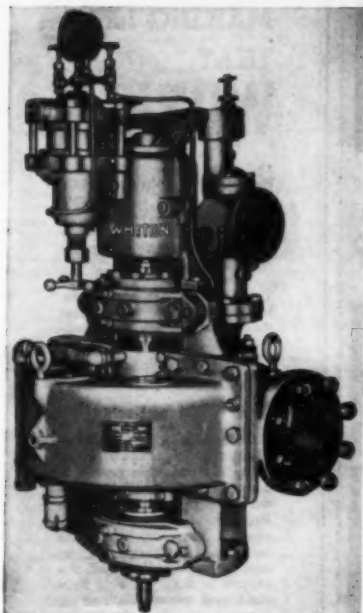


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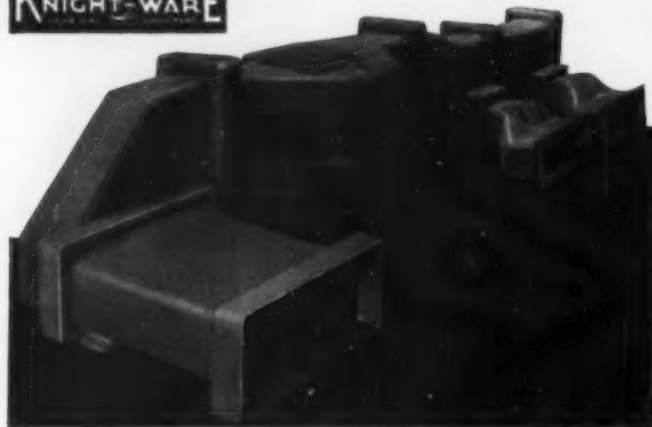
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P-9481, Chemical Engineering

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- 1—5'4" dia x 40' STAINLESS STEEL Rotary Dryer, Ruggles Coles.
- 3—Oliver Vacuum Filters, incl. 8 x 12', 11'6 x 14', 11'6 x 18'.
- 1—6' x 4' Flaker, chrome-plated m. d.
- 4—SWEETLAND FILTERS—No. 12 with 36 steel, bronze or Monel leaves; also #5.
- 1—ALUMINUM Sperry FILTER PRESS, 30" x 30", Plate and Frame, 45 chambers.

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Paul G. Abbe	18"	21 1/2"	Silas	1/4 H. P.	New York
Abbe	22"	18"	Porcelain	1 1/4 H. P.	New York
Paul G. Abbe	22"	23"	Porcelain	P. D.	N. J.
Abbe	22"	23"	Porcelain	P. D.	Miss.
Abbe	22"	23"	Porcelain	1 1/4 H. P.	Michigan
Patterson	48"	30"	Porcelain	P. D.	Virginia
Paul G. Abbe	48"	42"	Substone	1 1/4 H. P.	New York
Paul G. Abbe	64"	60"	Substone	3 H. P.	New York
Patterson	72"	68"	Silas	Gear Drive	N. J.
Patterson	84"	80"	Brick	20 H. P.	Illinois
STANDARD	24"	18"	Unl. Steel	Gear Drive	Calif.
STANDARD	24"	18"	Unl. Steel	P. D.	New York
STANDARD	24"	18"	Unl. Steel	P. D.	Ohio
STANDARD	24"	18"	Unl. Steel	P. D.	N. J.
STANDARD	24"	18"	Unl. Steel	P. D.	Nevada
STANDARD	24"	18"	Unl. Steel	P. D.	Calif.
STANDARD	24"	18"	Unl. Steel	P. D.	N. M.
STANDARD	24"	18"	Unl. Steel	P. D.	Arizona
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- 3—Shriver & Sperry 12", 18", 24", 30", 36", 42" & 48" Iron & Wood Filter Presses.
- 3—12" Brown & Rubber Filter Presses. Extra 30" Iron Shriver Plates & Frames.
- Goodland, Falso, Oliver & Valley Rotary Van Filter.

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- 1—Good 1000 gal. closed Agit. Jack, Kettle. Also smaller sizes.
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- 3—Jacketed Kettles 50 to 1000 gals.
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- 1—Robinson 22" Attrition Mill.
- 1—Robinson No. 18 Jaw Teeth Crushers.
- 1—Double Roll Crushers 18" x 12" & 12" x 12".
- 1—Lohman & Hall W. C. 12" x 30" Steel Mill.
- 1—Lohman & Hall 3 Roll Steel Mills, 6" x 14", 8" x 22", 10" x 20", 12" x 30" & 14" x 40".
- 1—6" x 24", 3 Pair High, Steel Roll Mill.

- 3—Hoskins 18" x 30", 4 Roll Granite Stone Mills.
- 1—Hardinge Conical Ball Mill 4 1/2" x 24". Also other sizes.
- 2—Stokes Pebble Mills 6" x 6", 3" x 3 1/2" & 2" x 2 1/2".
- 3—Abbe Jar Mills Lab to 10 gal. sizes.
- Rotary Cylinders, Ball Pulverizer, Fitzpatrick Comminuting Mills, Etc.

MIXERS—ALL TYPES

- 7—Baker-Parkins heavy duty double arm Jack mixers, 200 & 5 gals.
- 12—Harris Mixers 50 to 200 gals, single & double 200.
- 6—Pony or Paste Mixers, 6, 10 & 40 gals.
- 1—Century 5 HP, 4 speed Vert. Mixer.
- 4—Pony Mixers 50 to 100 gals.
- 4—Mason Intensive Mixers 20 to 5-16.
- 1—Master Drum Type Blender 1000 gals.
- 10—Dry Grind Mixers 50 to 2500 gals.
- 12—Portable Elec. Liquid Mixers 1/2 to 3 HP.

SCREENS & SIFTERS

- 2—Tyler 125 Jr. Vanner Screens, 28"x30".
- 1—Mater Sifter 28"x30", 4 Surfaces.
- 8—Reiter Sifters 18"x18" to 48"x48".

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- Stokes 18" grinder Tablet Machine 2 1/2" dia.
- Cotton 247 grinder Tablet Machine 1 1/2" dia.
- 4—French Oil 400 Tons Lined & Coated Hdr. Presses.
- 6—French Oil Motor Driven Crushers.
- New 9" x 12" Lab Mixing Mills & Calenders.
- 4—Farrel 18" x 30", 18" x 48", 18" x 48" & up to 22" x 60" 2 Roll Mixing Mills.
- 3—Rubber & Plastic Extruders 1 1/2" to 6".
- 3—Stokes 28 Paste Fillers up to 5 gal.
- 1—Mason 2000 Stainless Steel Homogenizer.
- 4—Stokes & Smith & Day Powder Fillers.
- 1—Hilling Mechanical, Liquid, Paste & Powder.
- 3—Stokes & Cotton Rotary & Single Push Tablet Machine, 1 1/2" to 2".
- 2—Looming Press 30" x 30".
- 10—Stokes Vert. High Van. Pumps.
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- 1—Niagara Stainless Steel Filter, 146 sq. ft.
- 1—Alsop Stainless Steel Filter, Type SD-8-10 NR.
- 3—Louisville Rotary Steam Tube Dryers, 6' x 25'.

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1951



- 1—Telford Stainless Steel Suspended type Centrifuge, 40" Perforated Basket.
- 1—Telford Stainless Steel Suspended type Centrifuge, 40" Imperforated Basket.
- 1—Steel Jacketed Vacuum Kettle, 2400 gal.
- 1—Shriver 30"x18" Filter Press, 34 Chambers, closed delivery & eye washing type.
- 6—Cast Iron Jacketed Kettles, 210 to 600 gals.
- 1—Bulovac Shelf Dryer, single door 17 shelves.
- 1—Bulovac Single Door Vacuum Shelf Dryer, 3 shelves.
- 1—Kawneer 125 H. P. Boiler, 125 lbs. pressure.
- 3—International 200 H. P., 125 lbs. pressure Boilers.
- 1—Shriver Filter Press, 30"x30", closed-delivery, side-feed, 25 Chambers.
- 1—Sperry 36"x18" Recessed Type Filter, centre-feed, open-delivery, 42 Harmlite covered Plates.
- 1—Sperry Aluminum Filter Press 18"x18", 9 Chambers.
- 3—Pfaudler Glass-Lined Jacketed Kettles, 300 gals. each.
- 3—Pfaudler Glass-Lined Jacketed Kettles, 330 gals. each.
- 3—Pfaudler Glass-Lined Jacketed Kettles, 360 gals. each.
- 3—Pfaudler Glass-Lined Jacketed Kettles, 400 gals. each.
- 1—Stokas Vacuum Kettle with agitator 14"x12".
- 1—Copper Jacketed Kettle, 6'x8' with agitator.
- 3—Pfaudler Glass-Lined Jacketed Reactors 1,700 gals. each.
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- 3—Stainless Steel Storage Tanks 50, 100, 221 gals. each.
- 3—Stainless Steel Clad Storage Tanks 3,100 gals. each.
- 3—High Chrome Storage Tanks 3,600 & 6,000 gals. each.
- 3—Black & Clawson Double Drum Dryers 20"x5'.
- 1—Rupples Cole Direct Fired Kilo 7 1/2'x60".
- 1—Banbury Mixer #1 with 50 Hp motor.
- 4—Baker Perkins Jacketed Vacuum Type Double Arm Mixers with Motors & Drives, 100 gals. each.
- 1—Cannonave Vacuum Type Double Arm Mixers with Motor & Drive, 100 gals. each, Stainless Steel.
- 2—Cannonave Steel Jacketed Mixers, Chromium Plated, interior double arm, Bakelite blades, 100 gals. each, vacuum type with 40 HP Motors & Drives.
- 3—J. H. Day Double Arm Jacketed Mixers, 50 gals. each, sigma blades.
- 1—Baker Perkins Laboratory Mixer, size #8.
- 1—Baker Perkins Double Arm Jacketed Mixer, 300 gals. each, sigma blades.
- 3—Baker Perkins Double Arm Mixers, 200 gals. each, sigma blades.

- 1—Patterson 5,000 gals. each, Turbo Mixer "Un-used".
- 2—J. H. Day Mogul Type Mixers, 2 1/2 & 8 gals. each.
- 3—Simpson #9 Intensive Mixers, "Un-used".
- 1—Simpson #1 Mixer.
- 2—Louisville Rotary Steam Tube Dryers, 6'x50'.
- 3—Bulovac Flakers 8'x12".
- 2—Bulovac Vacuum Drum Dryers, 34'x20".
- 2—Bulovac Vacuum Drum Dryers, 5'10"x18".
- 1—Day Poney Mixer 15 gals. each.
- 1—Gemco Copper Conical Blender, 3 1/2 cu. ft.
- 4—Bennett Filters, 10, 7, 2, 1 & Laboratory Size.
- 3—Valve Filters, #25, 20 & 3.
- 10—Alsop Bronze & Brass Filters, Model #PAK 12-4.
- 3—Oliver Rotary Filters, 8'x10', 8'x12', & 3'x4'.
- 10—Charles Super Pressure Centrifuges #6.
- 1—Charles Super Pressure Centrifuges, Stainless Steel Bowl, Model #167.
- 1—Pudisichak Stainless Steel Centrifugal Extractor Model #8080.
- 2—Mills Pulverizers #18H.
- 1—Boyle #1 Perforated Extruder, with heating unit.
- 1—Badger Stainless Steel Still with 14" Rubble Cap Column, 9 Plates, 25 sq. ft. Stainless Steel Condenser, Still Pot & Receiver.

- 1—J. P. Devine Vacuum, Jacketed Kettle, 2000 gal.
- 5—Copper mixing Tanks, 3100 gals.
- 2—Copper Columns, 36" x 80'.
- 2—Sperry 18" x 18" — P&F — closed deliv. filter presses; tin plated—20 chambers.
- 1—Shriver Jacketed Plate & Frame, Filter Press, 36" x 36", 48 chambers.

- 1—American Locomotive Stainless Steel Heat Exchanger, Model Twin Double Pipe, Size 9 1/2"x27"x24.
- 4—Steel Heat Exchangers, 600 sq. ft. each.
- 1—Atlas Chalmers Tube Mill 8'x8'x10", Gilex-Lined.
- 3—Hardinge Central Ball Mills 8'x30", 8'x22", 8'x20".
- 1—Abbe Engineering Gilex-Lined Pebble Mill, 6'x12".
- 1—Abbe Engineering Gilex-Lined Ball Mill, 5'x6".
- 1—Ball Mill, Gilex-Lined, 7'x9".
- 1—Blaw-Knox Jacketed Autoclave 3'x2" with agitator.

- 1—High Pressure Steel Autoclave, 600 gal., 3'x4', with agitator and motor reducer.
- 1—J. H. Day #71 Ro-Ball Jacketed Stainless Steel Gyrating Screen Cooler.
- 3—Orville Simpson #41, Rolux Screens.
- 2—Wilson Pulverizers, Model #DELDG.

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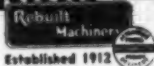
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- 2—Bird 40" Suspended, Steel.
- 1—Roberts 30" Suspended, perforated, steel.
- 2—Tolhurst 20", rubber-covered.
- 2—Bird 36"x30", solid bowl, Continuous, rubber covered.
- 2—Bird 36"x50", 24"x38", solid bowl, Continuous, steel.
- 1—Baker Perkins 48" "Ter-Moor" Continuous.
- 3—Sharples 26, steel.
- 2—Sharples 2PH-14 Super-D-Centers, stainless steel construction, with 10 HP ex.-proof motors.
- 1—Sharples Misco Separator, S.S., 2 HP motor.

FILTERS

- 2—Oliver monel 8'x18' Rotary Vac.
- 2—Valles 249 Pressure Filters, 31 leaves.
- 3—Sweetland 212 Filters, 72 bronze leaves.
- 1—Sweetland 210 with 27 monel-covered leaves, 4" centers.
- 1—Sweetland 212 stainless steel, 12 leaves.
- 7—Oliver Rotary 11'6"x18", 8'x12", 8'x8", 5'4"x8", 3'x4", 1'x1".
- 1—Swenson Rotary 4'x5'.
- 2—Sperry 36"x36" recessed, 50 chambers.
- 4—Shriver 30"x30" P&F, 30 chambers.
- 1—Sperry Aluminum 30"x30" P&F, 28 chambers, with hydraulic closure.
- 2—Shriver 18"x18" P&F, 15 C.I. chambers.
- 2—Sperry Type, 20"x20", recessed, 35 C.I. chambers.
- 1—Sperry 24"x24" bronze P&F, 22 chambers.
- 1—Shriver 12"x12" P&F, 12 chambers.
- 10—Shriver Skeletons, 18" to 42".

PULVERIZERS

- 2—Bauer 36" Attrition Mills, each with 2-50HP motors.
- 1—Raymond 245 Imp Mill.
- 1—Patterson 6'x18' Manganese Jacketed Ball Mill.
- 1—Abbe 5'x6' Manganese Jacketed Ball Mill.
- 3—Abbe 6'x8", 36"x42", 32"x38" Pebble Mills.
- 6—Patterson 4'x3", 3'x4" Pebble Mills.
- 1—Mike Pulverizer 25H.
- 5—Colloid Mills 8" and 4" dia., S.S.
- 1—Williams 20"x18" Hammer Mill.
- 1—Jeffrey 20"x18" Type B Hammer Mill.
- 6—Hardinge Mills, 10"x48", 8"x22", 6"x22", 5"x36", 5"x22", 4 1/2"x16".
- 3—Day 16"x40", 12"x30", 9"x24", 3-Roll Mills.
- 3—Raymond 6", 8" and 4" Air Separators.
- 1—Simpson Intensive Mixer 21 1/2".
- 1—Ball & Jewell 21 1/2" Rotary Cutter.

SCREENS

- 8—Roto Screens 40"x84", 40"x120", 60"x120".
- 1—Robinson 40"x34" Stainless Single Deck.
- 10—Tyler Hammer 3'x3' Triple Deck.

KETTLES

- 6—2000 gal. steel jacketed agitated Kettles, 200# psi.
- 10—Stainless 20 to 500 gal., jacketed.
- 1—3200 gal. Horizontal rubber-lined Tank.
- 2—Bullovak 6' dia. Crystallizers.
- 1—2'x15' Jacketed Crystallizer.
- 25—Paudler Sectional glass-lined Tanks, 7500 gal., 2350 gal.
- 2—200 gal. glass lined jkt. Agitated Kettle.
- 1—Stainless Steel Tank, Hor., 2500 gal.
- 6—Paudler 1000 to 2500 gal., jkt., glass-lined Mixing Tanks.
- 1—Patterson 150 gal. jkt. Autoclave, 300# pressure.

SPECIAL OFFERINGS

- 2—Oliver 8'x10' monel Rotary Vacuum Filters with monel valves, rubber-covered trough, agitator & repulper, complete with receivers, drives & motors.
- 1—Mojonnier double effect S.S. Evaporator 180 sq. ft.
- 6—2000 gal. steel, jacketed, agitated Kettles, 200# pressure.
- 1—Link Belt 5'x20' Roto-Louvre Dryer.
- 1—Link Belt 27'x8' Roto-Louvre Dryer, monel.
- 2—11'6"x18' Oliver Rotary Vac. Filters.
- 1—12500 gal. Hor. 10'x21'6"x1" Pressure Tank.
- 2—10000 gal. Hor. welded steel Pressure Tanks, 8'x27'x31/32", ASME Code, 225 psi.
- 2—8200 gal. Hor. Steel Pressure Tanks 70'x40'x2" for 390 psi.
- 5—3500 gal. Hor. Steel Pressure Tanks 3'x23'x7/8" for 300 psi.
- 1—Fuller C-30 Compressor.
- 1—16000 gal. Vert. Steel Tank 10'6"x25'x1/4".
- 1—16900 gal. Hor. Steel Tank 9'6"x32'x9/32".

MIXERS—ALL TYPES

- 3—Baker Perkins 20, 9, 1/2-gal., steam jacketed, Double Arm.
- 1—Baker Perkins 2 gal. S.S. Double Arm.
- 1—Hovos 2000# Horis. Powder Mixer.
- 10—Day, Robinson 100# to 2000# Powder.
- 25—Electric Portable Agitators 1/4 HP to 5 HP.
- 2—Ross, Porter 40 and 30 gal. Pony Mixers.
- 9—Day Wall Mixers, 180 gal.
- 1—Simpson Intensive Mixers 21 1/2".

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- 2—Batteries of two each Roberts 40" Centrifugals, copper perforated baskets, with Mixers.
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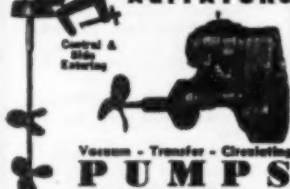
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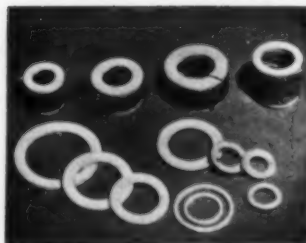
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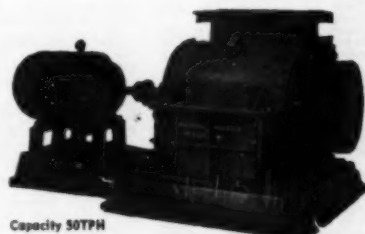
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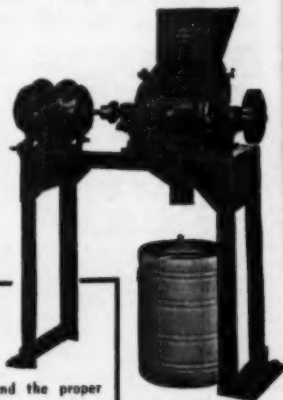
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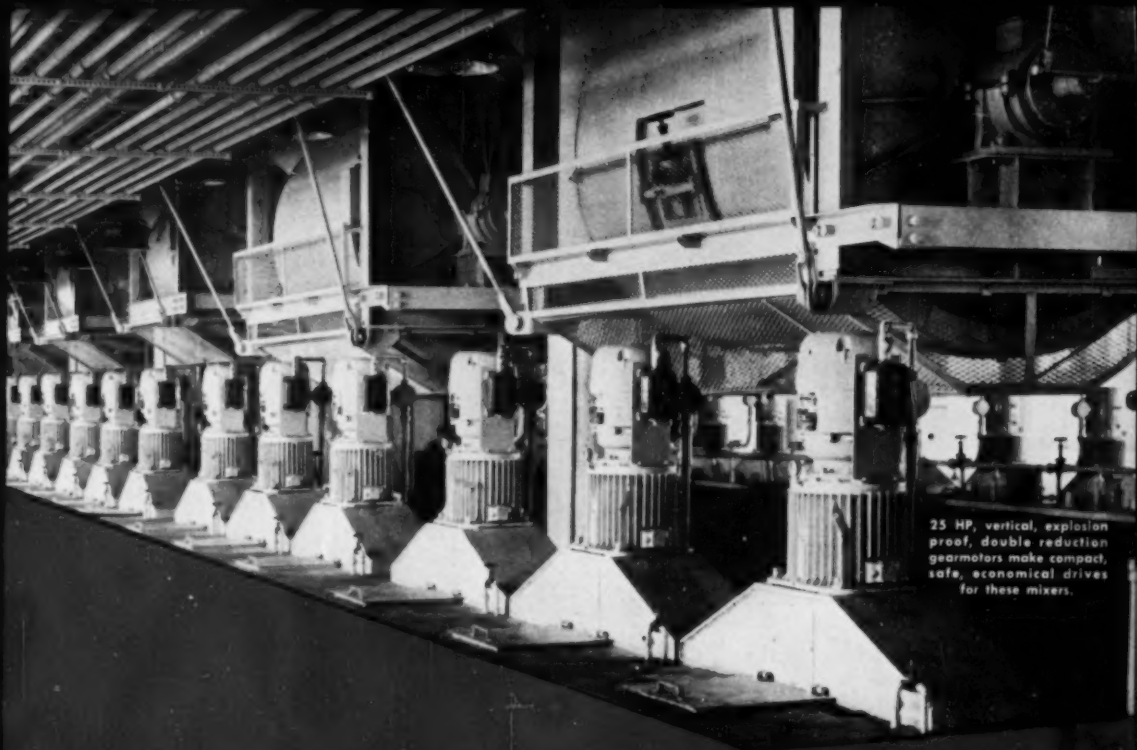
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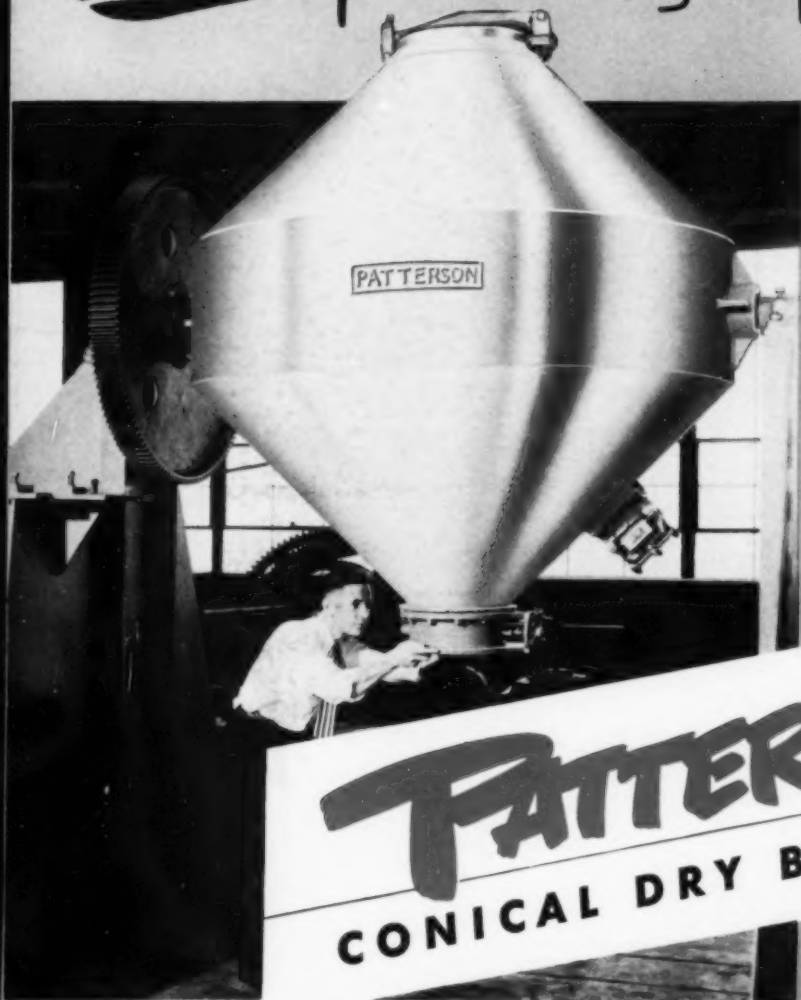
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